The
Electrical Review

VOL. CV. AUGUST 16, 1929. No. 2,699.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

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Telegraphic Address: "AGEEKAY, CENT, LONDON." Code, A B C. Telephone No.: Central 6871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 6d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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The Domestic Hot-water Supply.

THE heating of water electrically for domestic purposes has lately attracted a considerable amount of attention from supply engineers. This is not surprising when the desirable features of the load are considered. The consumption of a water heater is not less than that of a cooker, but if its supply is taken at night only it can never make a demand during the peak or cause a shifting of the peak incidence; in an article elsewhere in this issue it is given as 50 per cent. more. The encouragement of a night thermal storage load (of which domestic hot water is an important feature) in Switzerland has caused the night load in the large towns to be from 60 to 80 per cent. of the peak. Due to this policy, the load factor of Bâsle is now about 70 per cent., compared with less than 30 per cent. in 1910. In the United States of America, on the other hand, many undertakings do not restrict supply to the night hours, but advocate keeping one element continuously in circuit—a second element of somewhat larger capacity being switched in as requisite. It is claimed that the second element is rarely used on the peak and that its diversity factor is favourable. Relatively high prices, such as 0.75d. per kWh, are, however, charged and more willingly accepted in America than in Europe, where 0.4d. per kilowatt-hour appears to be a usual figure for restricted-hour water heating, whether supplied from steam- or water-power stations. We understand, moreover, that the municipality of Amsterdam (which has a steam station) has in view a tariff for this service very much below the figure named. Because of the competition of coke and gas, 0.4d. is a higher figure than would be possible in Great Britain to secure results equivalent to those now obtained abroad. At 0.4d. per kilowatt-hour, electricity, on a thermal basis, would cost two and a quarter times as much as coke at £2 per ton and rather more than gas at 8½d. per therm (ELECTRICAL REVIEW, October 19th, 1928, p. 646). In practice, there is evidence that the difference between the cost of electricity and coke is very much less than these figures would indicate; in fact, electricity at 0.3d. would appear to be competitive. When the advantages of thermostatic control, cleanliness, and elimination of coke storage are added, there seems no reason to doubt

that a large and paying business is obtainable at about one-third of a penny. We publish elsewhere in this issue an article describing what is being done to this end in an undertaking that is not among those of the largest output or lowest costs in the country. We agree with the author that for night water heating capital charges and other standing charges can be ignored and that the cost of the energy is merely the additional running charge—mainly coal. A considerable proportion even of the coal used at night is a standing (or stand-by) charge, and there appears to us to be ample margin in hand to justify the tariff commercially.

Mr. Davidson's method of reducing heat-losses in the storage tank is a simple and inexpensive way of meeting the case of existing installations owned by consumers who often cannot afford the cost of a specially-designed storage tank. So far there are, we believe, not half a dozen undertakings charging less than 0.4d. per kilowatt-hour for water heating, but the number will inevitably increase rapidly as the commercially more cautious engineers find that the efforts of their neighbours are attended with success. Then a large proportion of new houses, of whatever type, as well as older houses of the better class, will be fitted with specially-designed thermal storage tanks of high efficiency. The "point fives" of admired memory were, in their day, in advance of the designers of electrical apparatus. The position is now reversed, and British designers now require only an opportunity to be able to supply the needs of consumers at the lower costs made possible by the large-scale production that will follow the general adoption of competitive tariffs.

British Goods and Unemployment.

The Federation of British Industries has again addressed a communication to the Government urging that in influencing the placing of public contracts it shall remember the overwhelming importance of utilising British plant and material. The Lord Privy Seal is advised that such a principle, which has been urged again and again since the end of the war, should be made a condition in all schemes in connection with Government proposals of the reduction of unemployment. The proposed expenditure of £75,000,000 is certainly calculated to decrease the number of unemployed in some measure, but the Federation adds it is most desirable that the assistance that it gives shall be extended to cover as many industries as possible. For this reason, therefore, the raw materials and the actual plant, both constructional and operational, should be obtained from British sources. It is worth imagining how valuable this £75,000,000 might be, laid out in this national way, upon the works thus described by the Federation:—Construction and reconstruction of roads, bridges, and canals; the reclamation of flooded lands; railway electrification and extensions; "the speeding up of the work of the Electricity Commissioners"; dock and harbour extensions, municipal and colonial development. The Federation mentions other effects, besides good orders, that such a policy would produce, such as greater experience, technique, and specialised knowledge, which would make us more successful in securing overseas orders; also improving our publicity abroad and preventing other countries obtaining the publicity from their repeated booking of our orders. Then the Government is reminded of the national economic re-action of placing orders abroad, and of the great benefit that maximum employment can fulfil in maintaining skill and craftsmanship at the highest efficiency by continuous application.

A separate note from Mr. R. Nugent, director of the Federation of British Industries, is in the vein that we have so often used to urge British electrical and allied manufacturers and the big corporations, companies, and works that are their customers to give British goods every possible preference when ordering, because they can thus reduce unemployment.

Possibilities in Canada.

By reason of its highly-developed electricity supply industry Canada is one of the world's most important electrical markets, although its population is only between nine and ten millions. As the Dominion has become an industrial country, it is able to produce the bulk of its own electrical requirements. In 1927 the gross value of the production of Canadian electrical equipment factories was $78,558,730, but there is also a considerable importation—$19,044,000 in 1927-28. Unfortunately, the United States provided $16,762,000 of that total, the United Kingdom securing less than a tenth of the trade.

For several years past United Kingdom trade with Canada has been giving way to the United States for several perfectly natural reasons. Primarily, the absence of frontier restrictions has encouraged a constant interchange of men and ideas between the Dominion and the United States, with the result that Canada has become imbued with American ideals and aspirations—not to say standards.

In the face of these circumstances it is not to be wondered at that many United Kingdom traders were beginning to look upon Canada as a lost market. Yet there is a ray of hope in the report by Mr. F. W. Field, Senior Trade Commissioner in Canada, which was reviewed last week.

In the first place, the unquestioning subservience to Chicago in the matter of electrical standards has given place to a measure of independence—the adoption of a Canadian Electrical Code. While this Code is by no means free from American influence, the standards have been altered so that British apparatus stands a much better chance than it did before. This is due to the assiduous attention given to the matter by representatives of British electrical manufacturers, who expended a great deal of time and effort in the Dominion while the Code was being compiled. Mr. Field makes special mention of the awakened interest of United Kingdom manufacturers in the Canadian market, and urges further visits to sustain this interest. Although the selling of the larger plant is considered a difficult matter, Mr. Field says that there are certain classes of electrical machinery particularly suited to local conditions, the marketing of which is not such a perplexing problem. "Given the proper sales organisation, a fairly satisfactory profit might be expected over the complete range of manufacturers." We hope that the report will stimulate the movement and lead other electrical manufacturers to investigate the possibilities.

Safety Work in Factories.

The major portion of the section contributed by Mr. G. Scott Ram, O.B.E., M.I.E.E. (senior electrical inspector) to the annual report of H.M. Chief Inspector of Factories and Workshops for 1928 (abstracted elsewhere in this issue) is devoted to accidents. There is an increase of 15 per cent. in non-fatal cases over 1927, but it is pointed out that the figure is less than it was 15 years ago, in spite of the very much greater use of electricity now. Mr. Scott Ram, rightly we think, claims credit for the regulations and inspection system adopted by the Home Office 20 years ago in bringing about this result. As it is, accidents due to electricity are only a little over a quarter of one per cent. of the accidents due to all causes.

Accidents at high-voltage occurred chiefly at generating stations and were in the main due to temporary lapses of competent men.

About 65 per cent. of the fatal accidents were occasioned by voltages of 250 or less. The use of portable apparatus and the absence or failure of earthing were, as usual, fritful causes of accidents, including several fatal ones.

The Home Office, at the end of 1927, opened the Industrial Museum which has as its most important object the setting up of a standard of safety. Last year the exhibits attracted some 8,000 people, including many makers of electrical apparatus.

Modern Oil-purifying Equipment.

An account of the "Stream-Line" renovator for switch and transformer oils, as supplied for the sub-stations of the Central Scotland Electricity Scheme.

THE Central Scotland electricity supply scheme of the Central Electricity Board, the first part of the national "grid" scheme to be put into commission, includes, among other features of interest, oil-purifying equipment on a comprehensive scale characterised by the use, for the first time on work of this magnitude, of filter plant constructed on the unique principle employed by the Stream-Line Filter Co., Ltd.

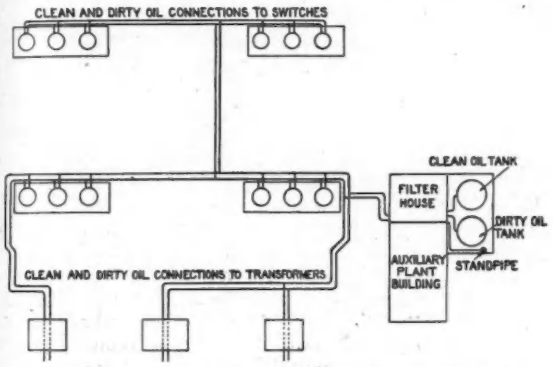


Fig. 1.—Layout of Oil-renovator Installation for a Central Scotland Sub-station.

Methods hitherto in use include the centrifuge and blotter press, usually in association, and often with additional chemical treatment. By such means the removal of final traces of carbon, fibres and moisture is a matter of some difficulty, whilst both types of plant require a good deal of attention and opening up for cleaning. The "Stream-Line" renovator, on the other hand, is claimed to be a simple static plant, requiring very little attention which is cleaned when necessary by the simple opening of appropriate valves providing for a reverse flow of compressed air. Details of this interesting filter follow, with some preliminary notes on the general arrangement of oil-storage equipment for the Central Scotland scheme.

Each of the thirteen sub-stations in the scheme is to be provided with a self-contained oil-storage and -purifying plant, comprising storage tanks for clean and dirty oil, a filter house accommodating the purifying and pumping equipment, and fixed piping linking up all switches and transformers with the tanks and filter house. The two storage tanks have a capacity of 3,500 gallons, sufficient to store the oil from the three phases of one switch. Oil can be drawn from any switch or transformer and stored temporarily in the dirty-oil tank whilst a charge of clean oil is pumped in from the clean-oil tank, the dirty oil being subsequently filtered and stored in the clean-oil tank. Alternatively, oil drawn from any source may be filtered immediately and returned, if desired, without previous storage in the clean-oil tank. The general arrangement of plant and piping has, in fact, been arranged by Messrs. Kennedy & Donkin (consulting engineers to the Central Electricity Board for the Central Scotland Scheme) in such a way as to give great flexibility of control, whilst for convenience all valves, except the shut-off valves at switches, transformers and tanks, have been grouped in the filter house, which thus forms a convenient control station.

Fig. 1 shows the general lay-out for a typical sub-station, and fig. 2 shows diagrammatically the arrangement of a filter house. From these drawings the broad scheme will be understood. It will be seen that the dirty- and clean-oil transfer pumps can be used independently of the filter plant, but that when the latter is in use the dirty-oil pump brings the oil to the plant and the clean-oil pump takes it away. This is so arranged, although the filter plant is self-contained and capable of providing its own suction and delivery heads, because in many cases the suction and delivery pipes are of considerable length. The oil transfer pumps are rated at 1,000 gallons per hour, which is sufficient to enable a defective switch to be rapidly dealt with, by using the clean oil already stored. The filter plant has a capacity of 300 gallons per hour, so that the clean-oil tank can be refilled by filtration in a day's run.

The oil-purifying plant includes a pre-heater (assisted by a heat-interchanger), a "Stream-Line" filter, and a vacuum receiver, from which dry clean oil is removed by a wet vacuum pump and air by a dry vacuum pump. In the preheater the oil is raised to a temperature of 80 deg. C., thermostatic control preventing excessive heating, and the oil then passes into the filter. Fig. 3 depicts the construction of the filter. This consists essentially of 91 columns, 3 ft. long, of washers 1⅝ in. in diameter mounted on square rods located at the top in a special division plate. The washers are of a specially prepared paper, and are spring loaded, so as to maintain a suitable compression. When filtering, liquid passes from the container around the columns, between the paper washers and up the central clearance into the filter head, the space above the division plate receiving only clean oil. Every trace of solid impurity, however

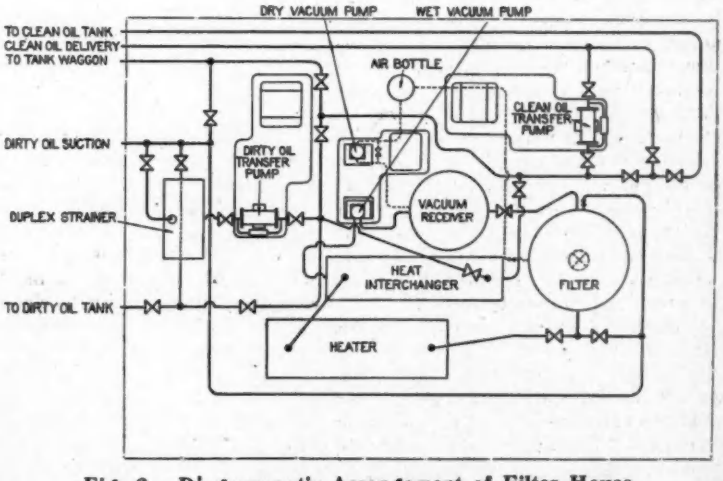


Fig. 2.—Diagrammatic Arrangement of Filter House.

finely divided, it is claimed, is held back at the edges of the paper washers, building up in time a uniform layer over the whole surface of the columns. It is in this respect that the Stream-Line filter differs fundamentally

from the usual type of filter or strainer. The highly efficient principle under review not only provides for the removal of every solid particle, but also enables the

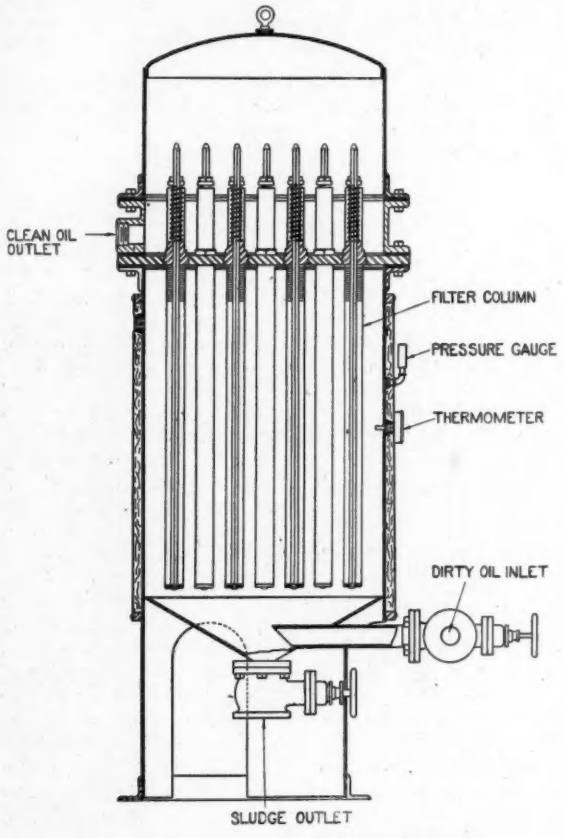


Fig. 3.—Construction of Stream-Line Filter.

cleaning of the filter itself to be very conveniently carried out. The uniform cake of solid which forms over the filter columns is entirely removed by simple reversal with compressed air, and it drops through a

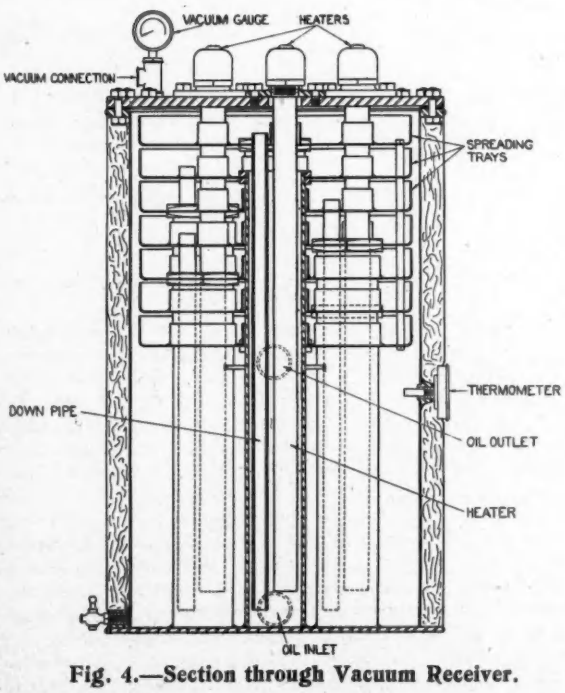


Fig. 4.—Section through Vacuum Receiver.

suitable sludge cock, the oil in the filter having first been drained into the dirty-oil system. The compressed air for cleaning is supplied from an air bottle charged by using the dry vacuum pump as a compressor, the change-over being accomplished by the movement of a control cock. Thus, in ordinary operation the filter is never opened up, whilst if any adjustment should ever become necessary, it can be made by simply removing the top cover, when the filter can actually be run under observation by using the dirty-oil pump to supply oil under pressure. It may perhaps be emphasised that the paper washers have no blotting action; they are rendered impervious by a special treatment. The paper used has no loose fibres likely to be introduced into the filtered oil, and the packs are claimed to have a life of several

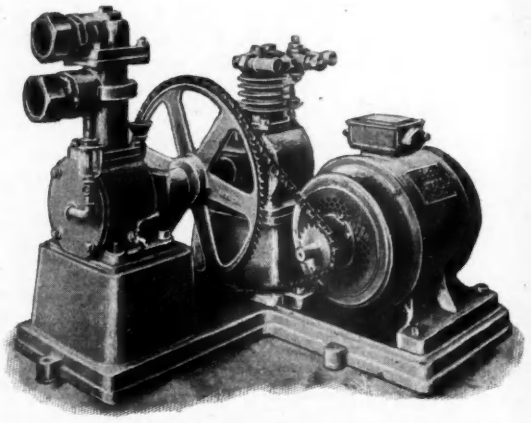


Fig. 5.—Wet and Dry Vacuum Pumping Set.

years under the conditions obtaining in this class of filtration.

Moisture is removed from the oil, not by any blotting action, but by evaporation under vacuum in conditions rendered especially favourable owing to the nature of the filter itself. Oil passes between the filter disks in thin films of almost molecular dimensions, and the combined effect of high temperature and vacuum releases the moisture as vapour. Some of this may condense before final elimination from the system; it does so, not in a highly emulsified state, but in a form readily amenable to evaporation. Oil and vapour pass from the filter

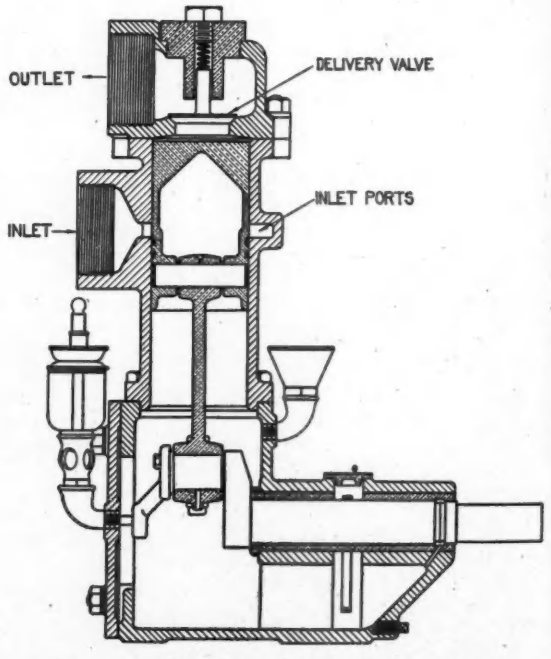


Fig. 6.—Construction of Wet Vacuum Pump.

itself into a vacuum receiver of special construction, fig. 4, in which the final separation of oil and water vapour is ensured. The oil encounters a series of heaters

and flows over a number of trays where the full benefit of heat and vacuum is obtained. Clean dry oil is finally withdrawn by the wet vacuum pump from a point near the bottom of the vessel, and air, gases, and water vapour pass off from the top of the vessel and out to atmosphere through the dry vacuum pump. It is an interesting fact that the complete dehydration of the oil cannot readily be achieved by the use of the special vacuum vessel alone—the previous action of the filter being essential to success. The vacuum vessel merely serves, in effect, as a convenient addition to the filter for the final removal of oil and moisture by different outlets. Fig. 5 shows the complete pumping set, including wet and dry vacuum pumps, and fig. 6 gives the details of the wet vacuum pump which, although of a rugged simplicity of design, is capable of developing a high vacuum.

The whole of the filter plant and the valves governing the piping system are conveniently arranged in the filter house. The piping is laid in chases, covered with chequer-plating through which the valve handles project. There is thus ample walking space around the plant, and the only moving parts—the pump drives—are protected by guards, so that the control of the equipment is safe and easy. Electrical controls are grouped on a side wall near the door. All piping within the filter house is of copper, and for external piping iron is used for dirty oil and copper for clean oil. An interesting feature of the copper pipework is the use of cone and nut unions to the complete exclusion of brazing. From the above particulars it will be seen that the filter plant is a completely closed system, so that there is no risk of the high dielectric strength of the filtered oil being impaired by exposure to the atmosphere. In conformity with this the clean-oil storage tank is, of course, fitted with an oil-sealed calcium chloride breather.

Results are now available showing the performance on test of the first filter equipment completed for Scotland, and these are of a striking character. The tests were carried out using oil which gave a breakdown voltage of less than 10 kV when measured in accordance with the specification of the British Engineering Standards Association. New oil of the same quality averages 40 kV. The results shown in Table I were obtained with the four samples of clean oil taken at intervals of 15 minutes throughout the test.

Table I.—Test Results.

Sample No.	Breakdown voltage.
1	50 kV
2	70 kV
3	Did not break down at 70 kV
4	70 kV

The comparatively low value for the first sample is considered to be attributable to defective sampling, and it appears that the actual breakdown value of the filtered oil is very greatly in excess of that of normal new oil. Fig. 7 shows the filter with the top removed, and fig. 8 is a reproduction of a complete plant assembled in the makers' workshops before dispatch to Scotland.

It is generally known that the Stream-Line filter, which was invented by Dr. H. S. Hele-Shaw, F.R.S., is used in connection with a variety of filtration problems, and electrical engineers will watch with interest its application to the problem which most intimately concerns them.

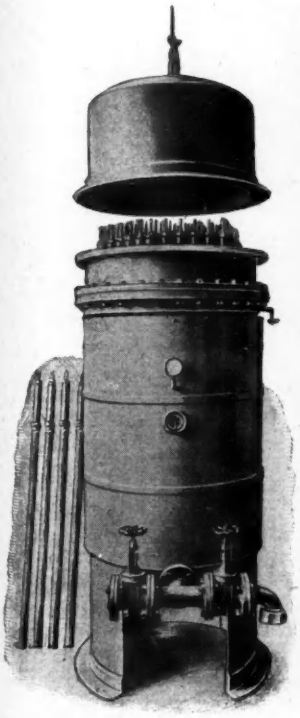


Fig. 7.—Filter with Top Removed.

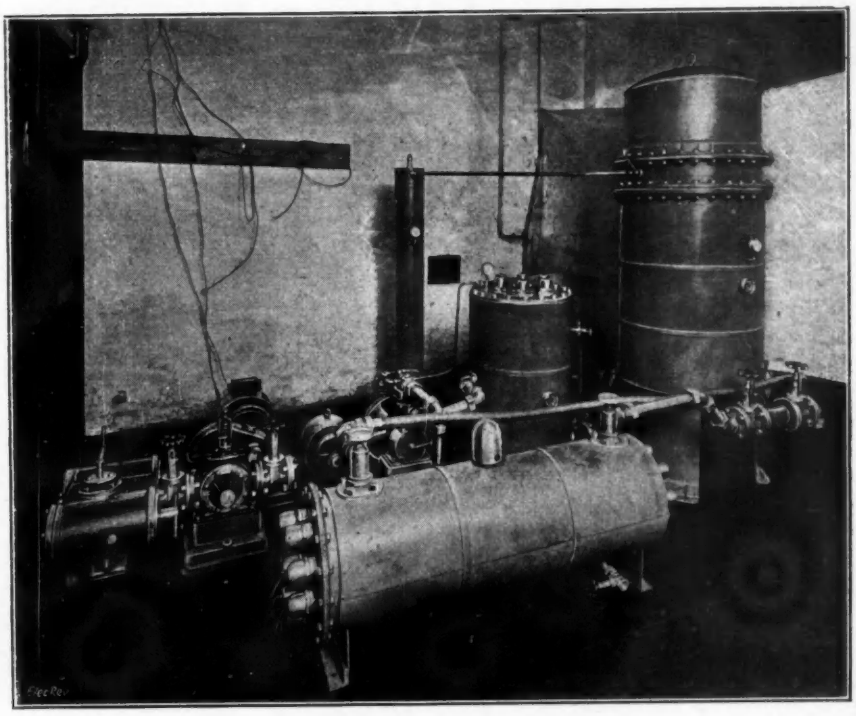


Fig. 8.—Complete Oil-purifying Installation.

Central Board Accounts.

The first statement of accounts of the Central Electricity Board has been issued (Whitehead, Morris, Ltd., Tower House, Holland Street, London, S.E.1; price 1s. net). Covering the period from March 1st, 1927, to December 31st, 1928, it shows that of the maximum which may be borrowed (£33,500,000) the Electricity Commissioners sanctioned £5,000,000 for general purposes (borrowing powers exercised = £276,670) and £5,000,000 for frequency standardisation (borrowing powers exercised = £62,330). The capital expenditure was made up of £100,322 on the construction and acquisition of main transmission lines and £199,956 representing payments to the Minister of Transport in respect of preliminary expenses and to the Electricity Commissioners in respect of the preparation of schemes and expenditure incurred by the Board (including £6,964 interest on temporary borrowings). Advances to undertakers of sums required by them for carrying out alterations in the frequency employed in their undertakings totalled £61,563. Outstanding commitments in respect of contracts totalled £2,893,000.

Variable Inductance Radio Tuners.

An account of an intriguing attempt to prove the possibility of dispensing entirely with the use of tuning condensers.

By T. E. LANDER.

So much is talked about unwanted capacities that it is amazing that the ordinary designer of radio-telephone broadcast receiving sets should think nothing of inserting as many as three or four variable condensers in a set, each of which may have a capacity in the neighbourhood of 0.0003 microfarad.

The greatest possible signal strength is admittedly obtained when the tuning coil happens to have precisely the right amount of inductance to counterbalance the stray capacities in the circuit in respect of the frequency to which it is desired to tune the set. There is no sound argument against the use of tapped coils, except the difficulty of obtaining a really reliable tapping switch, or plug-and-socket device, and some means of final adjustment which will allow of exceedingly small variations in inductance and, at the same time, cover a fairly wide band of wave-lengths, so that the tappings may not need to be too frequent, and all the stations lying between one tapping point and the next may be tuned in successively.

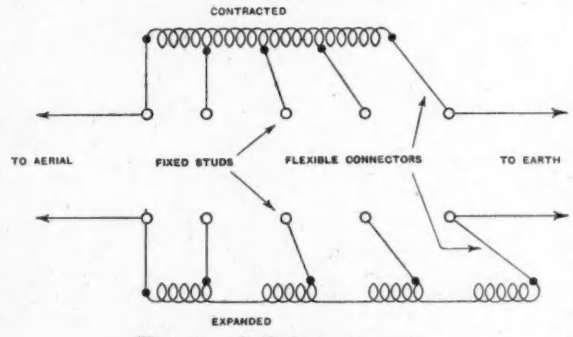


Fig. 1.—Coil Arrangement.

The value of Nagaoka's factor depends on the ratio of the diameter to the length of a coil. By employing that factor and substituting the proper value for it for K in the following formula, the inductance, in microhenries, of a single-layer coil may be calculated—

$$L = \pi^2 D^2 n^2 l K / 1{,}000.$$

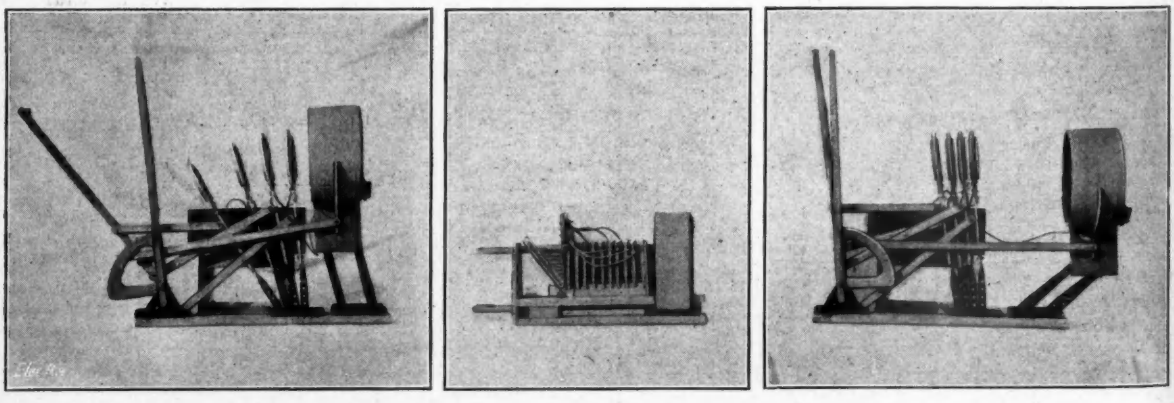
The sum of the individual inductances of two, or more, separate coils when connected in series, but placed in such a position (*e.g.*, so far apart) that they do not affect each other inductively, is less than the inductances of the same number of turns when closely wound in one continuous coil. Evidently, then, it must be possible to vary their collective inductance appreciably by arranging a number of coils so that they are all electrically connected in series and capable of being brought close together, or strung out, as illustrated in fig. 1. The diagram shows the correct location of the studs to require the shortest flexibles.

The author's first attempt to employ this type of tuning consisted in the use of "elastic" inductance, *i.e.*, a coil composed of phosphor-bronze, or other springy wire having good conducting qualities, which could be stretched out concertina-wise; but to obtain a reasonable range meant extending such a coil to a length which made it quite unsuitable for normal purposes. The possibility of increasing the range by tappings was tried, and while by this means it was possible to tune to much higher frequencies without extending the coil so far, the clumsiness of the coil itself was a drawback.

The author has made the following experiments: Fig. 2 shows an arrangement whereby three movable coils can be smoothly and gradually opened out fan-wise from a fourth stationary coil. Each coil consists of 15 turns of 22 s.w.g. d.c.c. copper wire wound on a leatheroid cylinder, and to keep the turns in place the coils are taped, bias cut. The coils can be short-circuited individually, or collectively, by means of short lengths of rubber-covered flex, to which are attached snap tags. The links between coils are brought out to snap terminal screws, and the earth and aerial leads are similarly equipped.

It has been stated that for sharp tuning, when direct aerial-coil tuning is employed, a fairly large condenser is necessary, but the fact remains that critically sharp tuning can be obtained even when all tuning condensers are dispensed with, simply by making the reaction coil of a very much larger diameter than the aerial-tuning coil. For example, with an aerial-tuning coil of 4 in. diameter a reaction coil of 7½ in. diameter is none too large. Signal strength is undoubtedly increased if the reaction coil approaches the same size as the aerial coil; maximum strength is reached when the aerial coil will just go inside the reaction coil, and when the number of turns on both the reaction *and* the aerial coil is adjusted to suit the desired wave-length.

So far as the author is aware, no commercial coils are procurable which permit of the aerial-tuning coil being



Figs. 2, 3 and 4.—Variable Inductance Radio Tuners.

inserted inside the reaction coil, as described. When experimenting with "elastic" inductances he so arranged matters that the aerial coil could pass inside the reaction coil, and the relative sizes finally chosen were those mentioned above, being a compromise between sharp tuning and loud signals.

It will be observed that the arrangement shown in fig. 2 does not permit of the coils, when open, being co-axial, or concentric, whichever one prefers to call it. The reaction coil, unlike the separate sections of the aerial-tuning coil, is not built in sections, but in one unit. The coil itself is tapped, however, and it is worth noting that, being mounted on two arms, its motion is a parallel one; it does not describe an arc as the sections of the aerial-coil do. The quadrant on the left is coupled to the reaction coil by the long horizontal push-rod, and its purpose is to allow the operating lever, which controls the reaction, to be sprung from one of the five locating holes visible in the arc of the quadrant to another, thus enabling both levers to be left in a vertical position out of harm's way when the set is not in use, or, alternatively, to allow for extreme positions of reaction or aerial coils as in figs. 4 and 6. The levers are made long as a safeguard against hand-capacity effects.

Fig. 3 shows a method of making the motion of the sections of the aerial coil parallel. Incidentally, it also provides a comparison between having a small number of coils, each having a fair number of turns, and capable of being separated a good distance, as shown in fig. 2, and a large number (ten in this instance) having a small number of turns (seven turns each in this case) and not capable of very wide separation.

Fig. 6 shows the other extreme position, in which case the base-board has been made double, the reaction coil being drawn in and pushed away by the lower horizontal push-rod. The separation was limited in this case by the relative forces acting on the pivots on the horizontal bearers, relative to the surface of the slot in the slotted member, and, of course, by the inclination of the rocking arm itself. The further the arm is inclined from the vertical the greater the resistance to movement due to friction.

Each section of the aerial-tuning coil is mounted on a separate horizontal rod; they are pushed collectively backward and forward by the slotted member pivoted on the base. The tapping-panel, a good view of which is obtained in fig. 8, in this case moves with the section nearest the operator. The compactness of this arrangement and the relative sizes of both are well illustrated in figs. 6 and 8.

Having secured the empirical data obtainable with these two arrangements, the author then set about

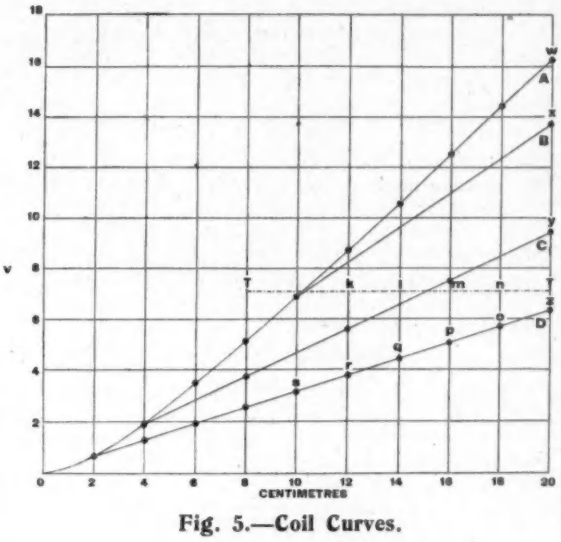


Fig. 5.—Coil Curves.

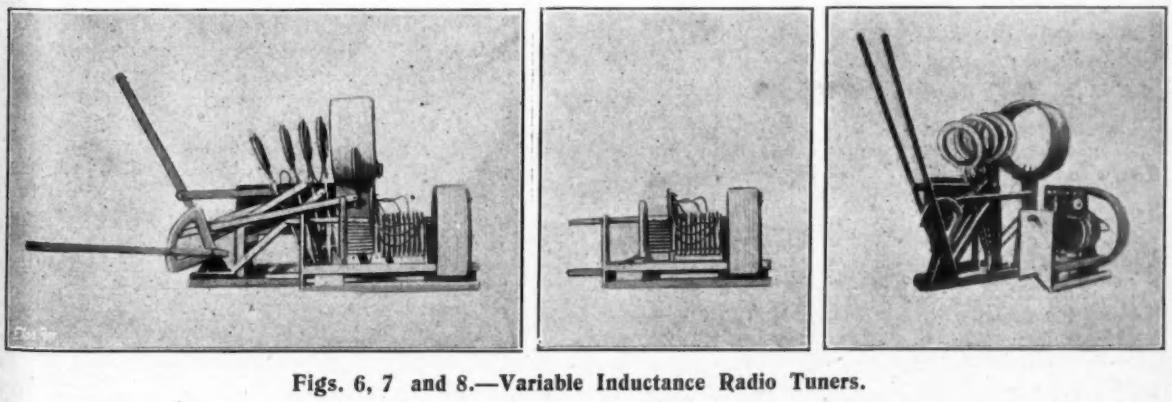
making some elementary calculations as follows: Reverting to the formula $L=\pi^2 D^2 n^2 lK/1{,}000$, suppose we take a coil 10 cm. in diameter and 2 cm. in length. Given that L=the inductance in microhenries; $\pi=3.1416$; D=diameter in cm.; n=number of turns per cm.; l=length of coil in cm.; K=Nagaoka's factor; then $D/l=L$ and $K=0.3198$.

Let us compare the 2-cm. long coil with others 4, 6, 8, 10, 12, 14, 16, 18, and 20 cm. in length, otherwise similar. It is obvious that their relative inductances will vary in direct ratio to Nagaoka's factor, multiplied by their respective lengths, and we may neglect the $\pi^2 D^2 n^2$ term (denoting it by c) thus—

For coil 2 cm. long, $Lc=2K$.
" " 4 " " $Lc=4K$.
" " 6 " " $Lc=6K$.
" " 8 " " $Lc=8K$.

TABLE I.

Curve A				Curve B		Curve C		Curve D	
Length	D/l	K	$V(=lK)$	Length	V	Length	V	Length	V
2 cm.	5.00	0.319	0.638	10 cm.	6.880 (= lK Curve A)	4 cm.	1.880 (= lK Curve A)	2 cm.	0.638 (= lK Curve A)
4 "	2.50	0.470	1.880	20 "	13.760 (= 6.880 × 2)	8 "	3.760 (= 1.880 × 2)	4 "	1.276 (= 0.638 × 2)
6 "	1.66	0.525	3.450			12 "	5.640 (= 1.880 × 3)	6 "	1.914 (= 0.638 × 3)
8 "	1.25	0.638	5.104			16 "	7.520 (= 1.880 × 4)	8 "	2.552 (= 0.638 × 4)
10 "	1.00	0.688	6.880			20 "	9.400 (= 1.880 × 5)	10 "	3.190 (= 0.638 × 5)
12 "	0.83	0.725	8.700					12 "	3.828 (= 0.638 × 6)
14 "	0.71	0.755	10.580					14 "	4.466 (= 0.638 × 7)
16 "	0.62	0.780	12.480					16 "	5.104 (= 0.638 × 8)
18 "	0.55	0.803	14.460					18 "	5.742 (= 0.638 × 9)
20 "	0.50	0.818	16.360					20 "	6.380 (= 0.638 × 10)



Figs. 6, 7 and 8.—Variable Inductance Radio Tuners.

The final term, *i.e.*, the total inductance, of this series is 10. For a coil 20 cm. long $Lc = 20K$, whereas the sum of the inductances of 10 separate 2-cm. coils in series would be $Lc = 10\ (2K)$.

Now glance at fig. 5. The four curves have been plotted from v, the values of the proportional inductances, from Table I for coils of 10 cm. diameter.

Curve A shows the increase of inductance plotted against the length of the coil when wound as a continuous coil. Curve B shows coil A split into two units. The maximum variation obtainable in this instance, from the full inductance, when the two coils are placed so close as to form one unit, to the other extreme, when they have no mutual inductive effect and consequently their total inductance can be represented by the sum of their separate inductances, is equal to the distance *wx*. Curve C shows the minimum inductance if the coil is split into four; and, finally, D shows the reduction when the coil has 10 sections.

One can deduce from the curves that the larger the number of separate parts which the coil can be split into, the greater the difference between the maximum and minimum inductance obtainable with the arrangement, provided that the parts can be equally widely separated.

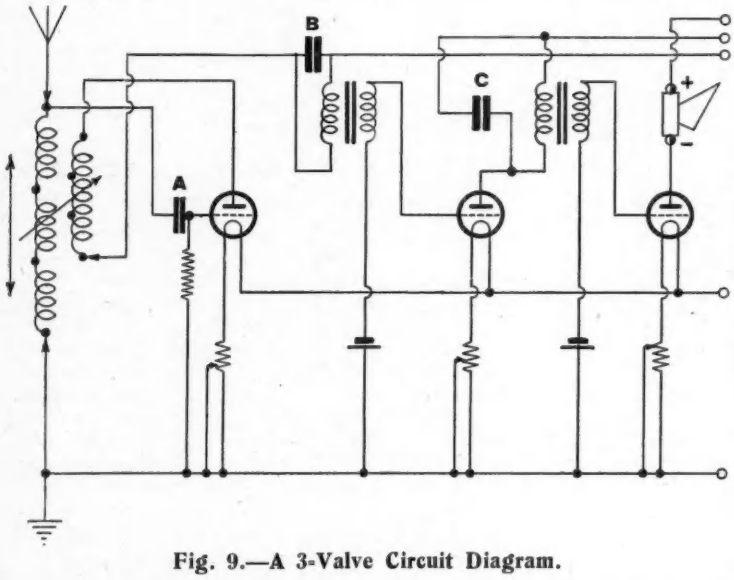


Fig. 9.—A 3-Valve Circuit Diagram.

All one is really concerned with at this point are the relative differences between *wx*, *wy*, and *wz*.

A further study of the curves makes it evident that with ten coils (curve D) there is a very good overlap. That is to say, suppose we are using ten coils, we can tune in a station at T by opening out the coils till the inductance drops from *w* to T, but we are then reaching the limit of our outward movement; in fact, we can only go to *z* at most. We can cut out one coil and close up from *o* to *n*, or cut out two coils and close up from *p* to *m*; we can, in fact, if we like, cut out four coils and close up from *r* to *k*, but, if we go a step further and cut out five coils, we find that even with full inductance station T is just beyond reach. Suppose, however, that we had been working with four sections, as in curve C, then we would have had no alternative but to cut out two sections and close up to *k*. Further, working with two sections only, as in curve B, the station would have been out of range entirely.

From the formula $L = \pi^2\ D^2\ n^2\ l_K/1{,}000$ it is deducible that the mutual inductive effect of adjacent turns in a coil is inversely proportional to the square of the distance between them. Let us again compare two coils, each having the same length and diameter. In this case, the term $\pi^2\ D^2\ l_K/1{,}000$ will be constant. The variable will be n^2 and, since n is the number of turns per cm. length, it is evident that the above-mentioned relation holds good. Applying this argument to the coil split up into sections, we may assume that each section acts on the others in inverse proportion to the square of the distance between them also.

Referring to fig. 3 again, the arrangement illustrated consists of an aerial-tuning coil split into ten sections, as described, and it so happens that with two sections only in action 5NO (Newcastle, 1,230 kilocycles) comes in when the coil is completely closed, while with all ten sections in action Vienna (519 m., 577 kilocycles) can be tuned in with the coil nearly closed. What is more important is that, with three sections in circuit, 5NO is just out of reach when the coil is extended to its fullest, *i.e.*, the station is audible, but the peak point is unattainable. We may, then, say that the total inductance of two of these sections close together is approximately equal to three sections opened out to the fullest extent possible with the arrangement shown in fig. 3. As more and more sections are brought into circuit, the overlap increases considerably until, with all ten sections in circuit, it is possible to tune from Vienna at about quarter extension to 5GB at $\frac{2}{3}$ extension; whereas with only nine sections 5GB still comes in, but at about $\frac{1}{3}$ extension.

This method of tuning loose-coupled high-frequency stages is also quite effective, but coils of comparatively fine gauge, say, 30 s.w.g., wound on formers of, say, $1\frac{3}{4}$ in. and $2\frac{1}{2}$ in diameter, respectively, should be employed.

The construction of sectional coils, whether for h.f. transformer or aerial-tuning purposes, presents a wide field for the display of ingenuity on the part of the constructor, not the least of the difficulties which the author has successfully overcome being that of making the turns of wire on the thin disks stop in place, even when wound to the very edge. Again, there is the difficulty of making a flexible link between one section and the next, which will stand up to constant flexing due to the to and fro motion of the sections.

It is not proposed, because there are too many variables to make the theoretical value sufficiently approximate to the actual to be of practical use, to calculate the theoretical limits of inductance variation obtainable by means of a system similar to the one illustrated; but as the tendency appears to be to complicate rather than to simplify the constructional details of sets, and to increase rather than to reduce the number of necessary components embodied therein, it has been the author's aim to describe briefly a practical method of simplifying the tuning arrangements and, at the same time, increasing their efficiency in any set wherein straight aerial-tuning and reaction are employed.

Fig. 9 illustrates diagrammatically the extreme simplicity of a 3-valve circuit employing variable-inductance tuning. It will be noticed that the only condensers in the set are three fixed ones: A being the gird leak condenser and B and C shunting the primaries of the two l.f. transformers. Dispensing with variable condensers reduces the space required. A set incorporating the fig. 9 circuit was built into a cabinet (excluding the tuning coils and batteries) measuring 6 in. by 8 in. by 8 in. overall.

Institute of Metals.

The arrangements for the Düsseldorf meeting of the Institute are now complete, and the meeting promises to be a notable one in every way; over 200 persons from ten different countries will take part in the gathering. The proceedings will open on September 9th with the annual autumn lecture by Dr. A. G. C. Gwyer on "Aluminium and its Alloys."

My Electric House.

The author's data and statement of operating results, obtained by personal use, should stimulate others to prepare similar records, which would be of considerable value for propaganda purposes, as representing actual installations.

By R. H. RAWLL, A.M.I.E.E., A.M.I.Mech.E.

MUCH has been written recently on domestic electrification and the many benefits to be gained therefrom, and, although considerable progress in the development of this class of load has been made during the last few years, there is still, however, a good deal of reluctance on the part of the average householder to take full advantage of the many conveniences which electricity in the home affords.

To a large extent that attitude is due to the uncertainty of the running costs. Consumptions of various electrical appliances are often given to intending purchasers as so many units per hour, and to the average layman, who naturally wishes to ascertain as accurately as possible to what extent he will be committing himself financially by their use, such information can hardly be considered to be exactly illuminating.

It is well known that very few electrical men practise what they preach as regards electricity in the home. Recently the author attended a meeting of electrical engineers in one of the largest cities in the provinces at which the subject of domestic electrification was under discussion. One of the speakers called upon all those who had all-electric houses to put up their hands. The result was only one hand! This is a most deplorable state of affairs. Electricity supply authorities to-day are continually being asked by intending consumers approximately what kind of bills they may expect should they

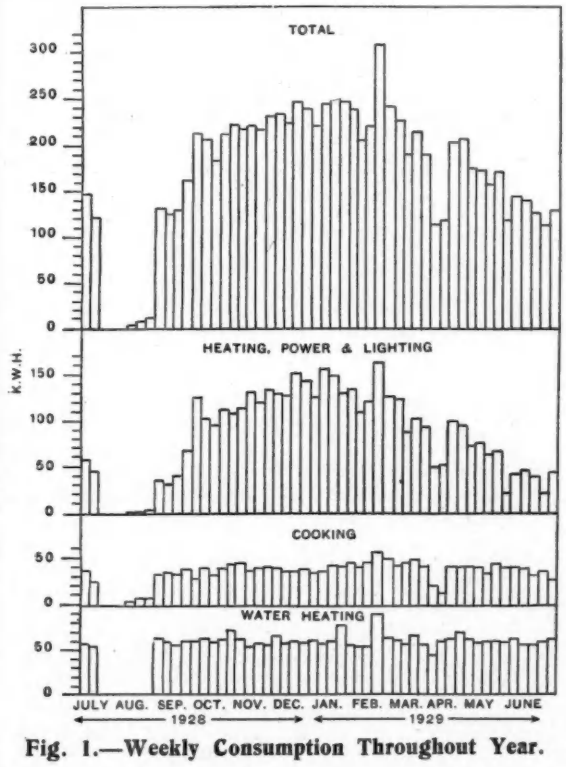


Fig. 1.—Weekly Consumption Throughout Year.

adopt electricity extensively in their homes. Usually the reply is to the effect that all depends to what extent it is used. It must be confessed that this is not very encouraging and is not calculated to increase the sale of electricity to such an inquirer. In the author's opinion examples of actual consumptions, costs, &c., of typical installations, together with the service obtained, should be available on such occasions.

During the last few years the author, as a matter of personal interest, has accumulated a considerable quan-

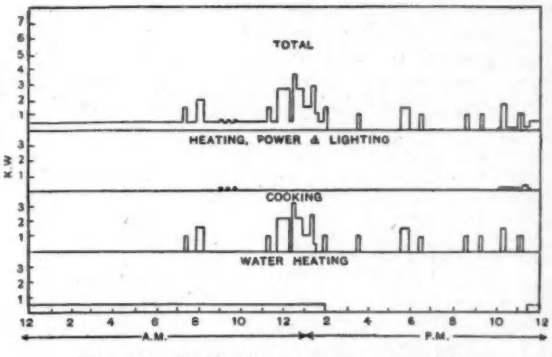


Fig. 2.—Daily Load Curves for July.

tity of data, such as weekly consumptions, daily load curves, &c., of his own private domestic installation. It is thought, therefore, that particulars of some of them may be of interest, and perhaps will stimulate others to prepare reports on similar lines, which could be used for propaganda purposes as examples of actual installations.

The house in question is typical of many thousands of post-war residences, *viz.*, it contains three bedrooms, two living rooms, a bathroom and kitchen-scullery. The lighting and power points are supplied from separate distribution fuseboards. There are two power-plug sockets in the dining room and kitchen and one in each of the remaining rooms, with the exception of the bathroom, which is not so equipped for safety reasons. The electrical equipment consists of the items enumerated in Table I :—

TABLE I.—ELECTRICAL EQUIPMENT.

Item.	Loading.	Item.	Loading.
Lighting	500 watts.	Fan	30 watts.
Cooker	7,000 ,,	Vacuum cleaner	150 ,,
Kettle	1,000 ,,	Immersion heater (3 heat) ...	2,000 ,,
,, ...	600 ,,	Wireless receiver	5 ,,
Radiator	1,500 ,,	Hot-plate ...	600 ,,
,, ...	600 ,,	Hair dryer ...	450 ,,
Iron	450 ,,	Battery charger	100 ,,
Curling tongs ...	30 ,,		
Total		15 kW. (approx.)	

The only gas used in the house is that utilised for the wash boiler in the kitchen, and, since it involves an annual bill of only 4s. 8d., it will readily be understood that it is very little used; also half a ton only of coal was consumed during the year, mainly for supplementary heating during the spells of exceptionally cold weather experienced during the past winter.

The consumption of electrical energy during the past twelve months has been as shown in Table II :—

TABLE II.— ANNUAL CONSUMPTION.

Quarter.	Lighting, heating and power.	Cooking.	Hot water.
July—September ...	407 kWh	242 kWh	410 kWh
October—December ...	1,600 ,,	506 ,,	757 ,,
January – March ...	1,550 ,,	559 ,,	764 ,,
April—June	739 ,,	474 ,,	757 ,,
Totals	4,296 ,,	1,781 ,,	2,688 ,,
Grand Total ...	8,765 kWh		

Fig. 1 shows the variation in weekly consumptions throughout the year. It will be noticed that the lighting consumption is included with those for heating and power, the former being very small compared with the latter. It is interesting to note that the extreme cold of the week ending February 17th last is reflected in the very heavy consumption at that time.

The immersion heater, which is fitted in the ordinary hot-water storage tank in the bathroom, is switched on

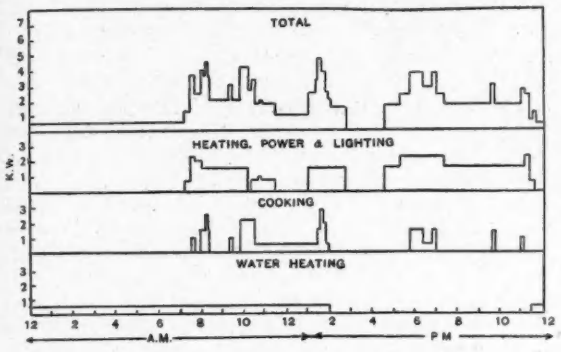


Fig. 3.—Daily Load Curves for January.

by hand at low heat (500 watts) on retiring at night and off after luncheon the following day, both in summer and winter. Of course, if a special water heater, thermostatically controlled, were installed, a considerable reduction in consumption for this item would result, but it was found that such an arrangement involved a considerable amount of plumbing work and undue expense. The present arrangement has been found to be entirely satisfactory, particularly in summer, on account of hot water being always available without the oppressive heat given out usually from coal fires during this season.

Figs. 2 and 3 have been obtained from recording-ammeter tests, and show, respectively, the daily load curves of the various items for July and January.

Electricity is obtained from the supply mains of the Birmingham Corporation under a two-part tariff, there being a fixed charge of £2 per annum (one-third being payable for each winter quarter in advance and one-sixth for each summer quarter) and a running charge of ¾d. per kWh; electricity for water heating is supplied at ½d. per kWh. The annual cost of electricity, including the hire of the cooker, is usually in the region of £27.

This may seem a lot of money to some people, but it must be remembered that there are no other bills for other forms of fuel. The cost of heating, also, which accounts for the major part of the total consumption, may at first sight be considered excessive, but it must be realised that no labour is required as regards ashes, laying and attending to fires, &c. No outside help of any character has been found necessary to assist in cleaning, &c., but it is certain that had coal fires been utilised some assistance would have been required, the cost of which, including meals for the person employed, would have been very much more than the extra cost of electric over coal-fired heating.

In conclusion, the author realises, of course, that the above results are no doubt peculiar to his own domestic arrangements and requirements, but, nevertheless, he is of the opinion that they represent those which would be obtained in the average middle-class household, which, after all, on account of the servant problem, is the largest field for electrical development.

Heat Expenditure Lines.

The author suggests that to make the lines more useful the fuel and evaporation figures should be based upon a pre-arranged fixed-heat value, leaving the variations in the initial heat value to be taken care of by a correction factor.

By WILLIAM D. WYLDE, F.I.F.

So much has been said and written about the graphic representation of the relationship of fuel in to steam out and power output to steam input, generally referred to as lines named after their originators, that it would appear to be quite in order to take it for granted that any method in question is all that can be desired for the purpose for which it is intended.

Such, however, is not the case with those lines representing fuel consumption co-ordinated with either the steam output or the power output, for the one reason that the calorific value of fuel is liable to and does in practice vary, even though it may be from the same seam, delivered with the same consignment from the same mine.

It is evident that for the plotted values to follow the linear law the fuel figure per unit of power and the evaporation per pound of fuel must remain at their predetermined values at the stipulated output, which of course they cannot do when the fuel heat value is a variable, with other controlling factors constant. It should, by the way, be noted that by taking the average of the fuel heat values, the plotted results cover the necessary thermal range, and it is this procedure that is generally adopted when constructing the respective charts co-ordinating the fuel input and power output for, say, the preceding month or year. From an operating point of view the taking of the average heat value of the fuel consumed alternatively to average pounds of fuel per kW-hour and average pounds of water evaporated per pound of fuel does not give the precision required when checking the results obtained from shift to shift, unless it so happens that the actual average heat value has been accurately determined beforehand, and the fuel per unit of power and the evaporation per pound of fuel calculated from the figure thus obtained has been included in the equation from which the line is drawn. Whether the latter is a feasible accomplishment is a matter of opinion, and depends primarily on the method of sampling, the storage capacity of the fuel reserve, fuel deterioration, and whether the fuels are mixed or not.

Take the case in which the results obtained are expected to be in close agreement with a predetermined line calculated from data prevailing with the fuel heat value, say, 12,000 B.th.u. per hour as fired. Should this specific heat value be maintained throughout the allotted period of time with the overall efficiency of the plant unimpaired, both the fuel in and units out and the steam output and fuel input transferred to their respective charts would coincide with the line already existing as a guide to efficiency. On the other hand, with the same overall efficiency maintained, a rise in the calorific value of the fuel would produce a point on the chart below the guiding line, which might possibly give the impression that better results were being obtained.

Conversely, should the heating value of the fuel decrease with the overall efficiency as before, the checking process would reveal an increase in fuel consumption, which could inadvertently be laid at the door of decreased efficiency.

Thus it is seen that, though the charts referred to are useful for denoting past results based on the average test value of the fuel, they cannot without modification be

used as an incentive to further effort by those directly concerned in the operation of plant from day to day.

It will be understood that the steam consumption line is not included in the remarks here made for reasons attributable to its not being affected by any variation in the thermal value of the fuel. It is in the light of the foregoing that the writer suggests that to make the lines more useful as a means of comparison for the operator, it is necessary to base the pounds of fuel per unit of power and the actual evaporation per pound of fuel on a prearranged fixed heat value, and to leave the variations in the initial heat value of the fuel to be taken care of by a correction factor as the following serves to show.

Dealing, in the first place, with the fuel-consumption chart, the equation of the Parsons' line holds good and is made use of for computing the datum fuel figure with the heat value 10,000 B.th.u. per pound.

The correction factor referred to would in this case be found as follows:—

where H = heat value of fuel B.th.u. per lb.

F = correction factor.

$F = H/10{,}000$.

To avoid calculations which do not materially alter the result, it is deemed desirable to reckon the no-load fuel consumption on the same basis, so that the fluctuation in the weight debited to this item, which naturally occurs when the potential heat of the fuel is a variable, is accounted for when the correction is applied.

The procedure involved includes the construction of the fuel-consumption line from the well-known equation

$$C = N + PK,$$

where C = fuel consumed per shift, day, or week in lb.

N = total no-load fuel consumption in lb.

P = datum lb. of fuel per unit of power, with the fuel heat value 10,000 B.th.u. per lb.

K = kW-hours or h.p.-hours per shift, day, or week.

The straight line thus obtained may be taken as being the graphical representation of the relationship of fuel into power out with a predetermined efficiency and fuel heat value maintained.

As before stated, should the heat value of the fuel vary it would be necessary to correct so that the actual fuel consumption per unit of power would be converted to a 10,000 B.th.u. base. For instance, taking a datum fuel figure of 1.5 lb. at 10,000 B.th.u. per lb. and assuming a fuel heat value of 12,000 B.th.u. per lb. as fired, the correction factor would be in this case

$$F = 12{,}000/10{,}000 = 1.2.$$

With B representing the pounds of no-load fuel allotted to each unit of power produced, *i.e.*, N/K, it will be seen that under identical operating conditions the actual fuel consumption per unit of power obtained over the specified period should work out at $B + 1.5/1.2 = B + 1.25$ lb., or taking the total consumption for the same period the corrected weight would be $C \times F$, because the actual equation for the line at the altered heat value would be

$$C/F = N + PK/F.$$

Thus it is plain that by applying the correction factor the total actual fuel consumed is converted to that corresponding to the consumption at the basic heat value and in all cases where x is the actual pounds of fuel per unit of power $P + B = Fx$.

Furthermore, with the plant efficiency maintained at the figure obtaining when the datum fuel consumption was calculated and based on 10,000 heat units per pound, it follows that the operating results after correction will coincide with the Parsons line.

Should x be greater than $P + B/F$ the plotted results would lie above the line, thus serving to indicate a decrease in efficiency; conversely, with x less than $P + B/F$ the results would appear below the line, thus denoting that the efficiency had increased.

Whether the latter is possible or not depends on the predetermined overall efficiency obtained or anticipated when fixing the datum fuel figure. With this value taken as the expected minimum based on maximum efficiency and output the possibility of the results falling below the line is somewhat remote; on the other hand, with the datum figure calculated from an overall efficiency which is capable of being improved upon, the incentive to maintain results that appear below the line would no doubt be accentuated. The remaining chart to which the correction factor can be usefully applied is that known as the evaporation line plotted from the equation $C = Z + YW$, where

E = datum pounds of water per pound of fuel.

Z = boiler house no-load fuel consumption in pounds.

Y = pounds of fuel at 10,000 B.th.u. per pound of water evaporated = 1/E.

W = pounds of water evaporated per shift, day, or week.

In this case again it is necessary to base the fuel consumption at zero output, also the datum evaporation per pound of fuel on 10,000 B.th.u. as the thermal value of one pound of fuel.

The application of the correction factor to the total fuel consumption in this again is $C \times F$ and the altered equation for the actual results would be $C/F = (Z + YW)/F$. As will be seen when the calorific value is constant $F = 1$ a correction is not required.

This conversion of the weight of fuel consumed over a period of time to the basic heat value referred to should, with the boiler house efficiency constant, result in the actual figures obtained and the previously calculated values being coincident. If they are not, the efficiency has either increased or decreased according to which side of the line the results appear.

It should be borne in mind that with the same operating efficiency maintained a decrease in load causes the fuel and steam consumption per unit of power to increase and the evaporation per pound of fuel to decrease. This is due, in the case of fuel and steam, to each kW-hour delivered being saddled with its share of the no-load fuel and steam consumed, respectively, which is naturally greater at lighter loads, and, in the case of evaporation, to an increase in that portion of the actual evaporation per pound of fuel debited to the boiler house zero load consumption.

As these deviations are taken care of by the equations from which the lines are constructed, it is proved conclusively that, when the corrected fuel consumption and/or evaporation do not agree with the plotted values, the operation of the plant is not consistent.

The remarks here made are not intended to give the impression that the original Parsons' fuel and water consumption lines are anything but a useful guide in showing how near a predetermined efficiency the plant has been operated over a period of time. For statistical purposes it must be admitted they have their value, but from an operator's point of view it is compulsory to introduce the necessary modification if the removal of the so-called bogey is desired. For a given fuel consumption per unit of power turned out it is clear that the evaporation per pound of fuel is a certain figure dependable on the potential heat of the fuel and other factors, which are assumed to remain constant at any particular efficiency.

Should it so happen, however, that the heat applied to the furnace per unit weight of fuel changes, say, in the minus direction, it is quite possible for those concerned to attribute the higher fuel consumption to a decrease in the overall efficiency from fuel to power, when in reality they may possibly be operating at a higher efficiency due to the initial heat expenditure being actually less than that from which the line was computed. The reverse applies should the fuel heat value change in the opposite direction.

The same desiderata apply to the evaporation line, because without a correction applied it may be assumed that an increase in the water consumed for the same fuel consumption represents an increase in efficiency which, after all, may be fictitious when the heating value of the fuel is revealed.

It is on this score that the taking of the anticipated average fuel heat value, whether it be premised, guessed, or obtained by the aid of the calorimeter, does not comply with the essential requirements of the man on the job if he is expected to conscientiously keep his results in the

vicinity of those previously determined and graphically represented as either an ideal to which to aspire or as a guide to assist in the maintenance of a pre-arranged efficiency, whichever the case may be. In the two cases outlined, should it be thought desirable to include (1) the pounds of fuel per unit of power and (2) the pounds of water evaporated per pound of fuel on their respective charts, the correction factor could be applied in a similar manner to that previously shown.

The Parsons' equation for (1), where R is the pounds of fuel per unit of power at any particular load, is $R=N/K+P$ or $R=B+P$. Here, again, it is evident that R is decided by the fuel heat value from which N and P are calculated, and any deviation from this figure must be allowed for by correction if the true value is desired. With N and P based on a heat value of 10,000 B.th. units per pound R will be the fuel consumption at this heat value; therefore by taking the figure in question as the basic heat value due allowance can be made for any variations in the usual manner.

Thus when the heat applied is a variable the value of R will be altered to $R=B+P/F$, from which it follows that when $x=R/F$ the operating results will fall on the curve, at the same time proving that the stipulated efficiency has been maintained.

Similar reasoning applies to the water evaporated per pound of fuel curve calculated from the usual equation $A=E-D$, when A represents the actual pounds of water per pound of fuel and D the boiler house no-load water debited to each pound of fuel consumed at a given load, *i.e.*, ZE/C.

In this case when the steam production efficiency is constant and the fuel heat value a variable $A=EF-DF$, and for the working value of A to coincide with the plotted values of the pounds of water per pound of fuel curve it is essential that $A/F=E-D$.

If the coincidence referred to does not materialise the boiler house efficiency is either greater or less than that from which the curve was calculated in the first instance. The advantage of preparing charts based on a fuel heat value arbitrarily fixed will perhaps be of more importance when the time arrives when the fuel consumer will pay for heat units delivered on the job.

When this happens there will be no need for correction factors, because it is possible to replace the existing fuel consumption ordinates by the heat expenditure in therms.

Thus one pound of fuel at 8,000 B.th.u. per pound would be graded 0.08 therm and 10,000 B.th.u. as 0.1 therm, and so on.

By substituting the therm equivalent for the total weight of fuel and for all the fuel values in the equations concerned, the lines and curves hold good for any grade of fuel, which simply means that applied with constancy to the operating efficiency both the resultant and the plotted values fall on the same straight line. The only disadvantage which prevents standardisation is that an alteration in the no-load fuel consumption necessitates another line and curve being drawn in the two cases under consideration.

Owing to the fact that heat expenditure is, and fuel consumption is not, a true guide to efficiency, it naturally follows that by basing the lines and curves on thermal expenditure a correction for the variation in fuel heat value is not required, for the specific reason that the production of one kW-hour at a predetermined overall efficiency necessitates the expenditure of a certain number of heat units, including those expended as no-load fuel, regardless of the weight of fuel consumed.

Naturally, it takes less fuel at, say, 14,000 B.th.u. per pound to liberate 10,000 heat units than it does at 12,000 B.th.u. per pound with the fuel burnt at the same efficiency in each case, and it is on this score alone that the only reliable indication of the commercial operating efficacy is the actual heat consumed in delivering one unit of revenue-producing power.

The accompanying chart shows the suggested alteration with the values converted from the original equations $C=9,000+1.3\ K$ and $R=9,000/K+1.3$ for the fuel consumption line and the pounds of fuel per kW-hour curve, respectively. These equations, with a fuel heat value of 12,000 B.th.u. per pound or 0.12 therm, were replaced by $T=1,080+0.156\ K$ and $R=1,080/K+0.156$ where T is the symbol for the heat expenditure in therms.

For the evaporation line on the same chart the original equations were $C=1,000+0.125\ W$, and $W=8C-8$ (1,000), which, converted to a fuel heat value of 0.12 therm as before, were substituted by $T=120+0.015\ W$ and $W=8T-8\times120$, respectively.

Briefly, the whole subject is purely and simply a question of either finding out or deciding (1) the heat it is necessary to expend to produce one unit of power, (2) the pounds of water evaporated for a given heat expenditure, and (3) the steam consumed per unit of power. A predetermined efficiency in each case is assumed.

Adding to (1) its requisite share of the no-load heat consumption gives the initial heat expenditure necessary at the particular output of the plant with operating

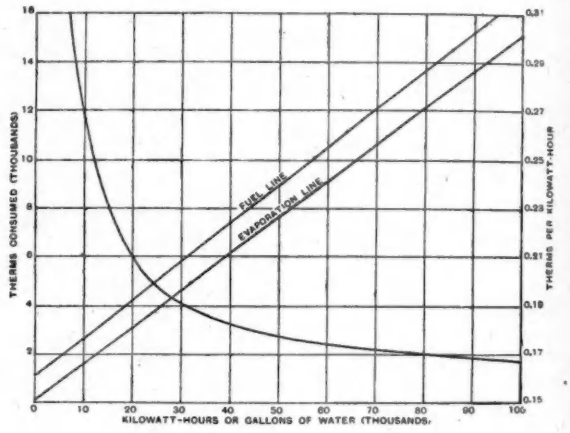


Fig. 1.—Corrected Parsons' Line.

conditions normal. In the case of (2) deducting the pounds of water which each consignment of heat entering the boiler furnace has to evaporate as its share of the boiler house zero load heat consumption gives the evaporation for a given total heat expenditure or weight of fuel consumed, whichever is taken as the basis for calculating the datum evaporation.

To (3) it is necessary to add the corresponding weight of steam which each unit of power turned out carries as its quota of the no-load steam consumption, the increment of increase being, as in the case of the heat expended per unit of power, inversely proportional to the power output.

By keeping the operating results in line with the aforementioned, those concerned are assured that the stipulated working conditions have been adhered to, and the necessary substantiation of this would be revealed by reference to previously drawn charts showing thermal expenditure co-ordinated with, in the one case, power output, and, in the other, water evaporated with the no-load heat consumption fixed throughout the load range for any individual plant.

Summating the essentials, all that is necessary is a knowledge of (1) the increments of no-load fuel heat and steam heat with which each unit of power produced is saddled, according to the output of the plant, and (2) the increment of boiler house no-load evaporation which the heat content of one pound of fuel must evaporate at the prevailing total fuel consumption.

With these values known along with the datum figures of the fuel heat expended per unit of power, the steam heat consumed per unit of power and the evaporation per pound of fuel or its therm equivalent, the essential guides are in evidence, and by maintaining the actual operating results in close agreement with (datum+increment) in the case of fuel heat and steam heat and (datum—increment) in the case of evaporation at the assigned load in each case, it may be safely concluded that all is well.

Problems of the Peak.

The practical aspects of electric water heating at night and during off-peak periods in residential districts.

By C. S. DAVIDSON, M.I.E.E., M.I.Mech.E.

IN a residential area where opportunities for improving the load factor of the demand are limited, electric water heating provides that scope which will enable such areas to improve the load factor of their demand by from 30 to 50 per cent.

Careful examination of the water-heating problem appears to indicate that with electricity at 0.33d. per kWh it is an advantageously financial proposition to the consumer.

The average undertaking, operating such an area as that indicated, to all intents and purposes loses its load at or about 10 p.m., the night load being of the order of 10 per cent. of the maximum demand for the year, whilst the coal consumption per kWh generated during the light-load periods increases some 100 per cent. If, therefore, off-peak energy can be supplied for water heating purposes between the hours of 10 p.m. and 7 a.m., it will be obvious that whilst the distribution efficiency will be slightly impaired the coal consumption must be enormously improved.

Bearing these factors in mind and having regard to the prices which will eventually be charged for bulk supplies of electricity, the prices at which water-heating supplies may be given are comparatively easily arrived at. As the service is already in existence and the additional consumption will not entail any extension of the standing charges, the only increase will be in coal and oil, or in the case of a bulk supply the unit charge, plus distribution losses.

At the works to which the writer is attached the coal consumption varies from 1.5 to 3 lb. per kWh generated, the maximum consumption occurring at periods of light load, that is, between the hours of 10 p.m. and 7 a.m.

If, therefore, we take coal and oil under the present night conditions and assume the price of coal to be 19s. per ton, the cost of generation becomes :—Coal 0.305d., oil 0.005d., total 0.31d. Since the additional load will have the effect of materially reducing the coal consumption, we will look to this saving to cover the losses in distribution and provide a profit on the supply. On the assumption that 1,000 kW was added to the night demand, it was confidently anticipated that the coal consumption would be reduced by some 1.25 lb. per kWh, the load factor for the year would be raised from 23 per cent. to 36 per cent., the average price obtained would drop from 1.77d. to 1.178d. per kWh sold, and the surplus yield would be raised some 10 per cent.

From the foregoing it will be seen that at 0.33d. water heating is a profitable business. A good deal of the criticism directed at the giving of cheap off-peak supplies indicates that Hopkinson's law has not been taken into consideration in arriving at the tariffs. If, without academic consideration of the law co-ordinating load factor and tariff, it could be demonstrated that the undertaking would benefit financially by the acceptance of a given load, then the law might in that particular instance be neglected.

If financial stability is to be maintained, regard must, however, be had to the load factor of the summation of loads and the resultant average price obtained. For showing the effect of improved load factor on the average price, take the case of an ordinary cooking consumer in the Barnes area. The present consumption is of the order of 3,500 kWh per annum, for which is paid an "all in" price of approximately 1d. per kWh. Were water heating adopted, the consumption per annum would be in the neighbourhood of 7,000 kWh, the average price would be 0.665d. per kWh, and the load factor of the demand would have been raised from approximately 10 to 20 per cent. If there is any virtue in the national system of bulk supply, there can be no justification for a higher unit charge than 0.25d., and at that figure 0.33d. would show an adequate rate of profit.

In the application of this additional service simplicity should be the keynote and, whilst for a time it will be necessary to install time switches and separate meters, it is hoped that the accumulation of data will permit of "all-in" tariffs being varied to suit the new demand without such complications.

The price at which the supply is afforded enables us to resist all temptation to play with the problem by installing geysers over sinks and such-like playthings that involve vast and unnecessary expense. We go direct to the existing hot-water storage tank, which already has all its connections, and into it we insert an immersion heater that is thermostatically controlled. For a 20-gallon capacity tank 1 kW is our standard loading; for a 40-gallon tank 2 kW. A time switch and meter are connected and an asbestos insulating mattress encasing the whole tank is neatly fitted. Some little plumbing may in some cases be found necessary to the outlet connection, as in many cases builders' practice has been to connect them to the rising main instead of to the tank outlet. There is in practice little heat loss in the circulating system, but in positions exposed to draughts pipes can be easily and cheaply covered.

Our present procedure is for the consumer to pay all the costs of the installation, arrangements being made when necessary to spread the payments over a period of time.

The requirements of hot water vary considerably in different households, but with a 20-gallon storage tank the consumer has the equivalent of 20 gallons of water, raised in temperature 140 deg. F., available each morning at 7 o'clock at a cost of threepence. Consumers are happy in receiving such a boon by so convenient a method and so cheaply, and the Electricity Department is gratified in further adding to its service to the consumer; the only disputants are the financial critics.

When 1,000 kW of immersion heaters has been added to our night-"restricted" load it is estimated that the present coal consumption per kWh will have been reduced from 3 lb. to 1.75 lb. and our price per unit generated will then be: coal 0.177d., oil 0.005d., total 0.182d., so that the margin available between that and the selling price will be a tolerable percentage.

There are 10,000 inhabited houses in Barnes, and 8,000 of them have at least part of their lighting and heating requirements supplied electrically. Many are "all-electric" and, although we are at present selling only slightly in excess of 200 kWh per head of the population per annum, we hope in the near future to catch up with many of the industrial areas both in respect of kWh sold per head of the population and in load factor.

Towards this end we have at present, and until such time as the demand exceeds that which permits of the most economical generation, removed all restrictions on electric water heating during the two summer quarters.

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Business and Industrial Notes.

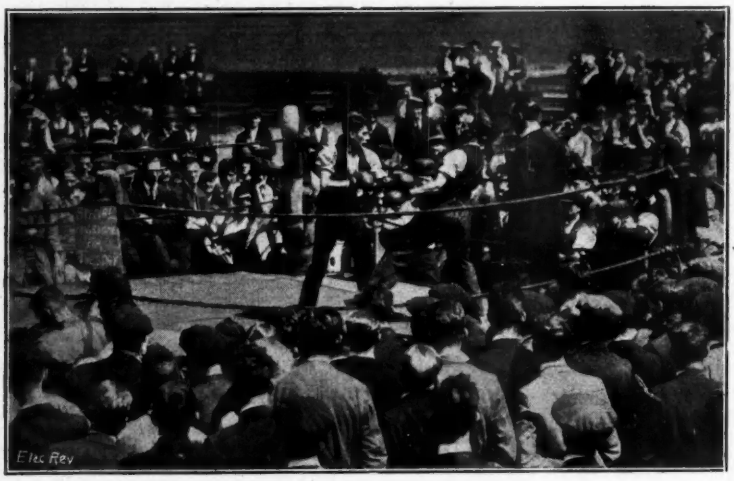
The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Anglo-Russian Business Relations.

A report telegraphed from Moscow on August 9th has been published in the German newspapers. The report states that a representative of Vickers, Ltd., of London, who was sent to Russia, has entered into negotiations with the Central Machinery Trust and placed before the latter proposals for the delivery of various kinds of machines. The deliveries would extend over a period of five years and the English company would grant the trust a long-term credit of the amount of 150,000,000 roubles (sic). It is further stated that the representative has been afforded the opportunity in direct negotiations with machinery-buying firms of informing himself of the details of the requirements of the Soviet Union.

Boxing at Dinner Time.

The accompanying photograph shows a quite usual scene which is witnessed in the works yard at Trafford Park, Manchester (Metropolitan-Vickers Electrical Co., Ltd.). At dinner time open air boxing has been popular lately and some



A Mid-day Scene at Trafford Park.

four or five thousand people have gathered round watching the events, which are properly refereed and conducted with all the usual formalities of a boxing ring. We are indebted to the *Manchester Evening News* for the photograph.

Electrical Workers' Wages in U.S.A.

According to a report on wages in the United States during 1928, which has just been issued by the National Industrial Conference Board, New York, the average hourly and weekly earnings and hours of work in electricity plants in July, 1928, were as follows :—

Classification of wage earners.	Average hourly earnings.	Average weekly earnings.	Average hours of work.
Inside production—			
Skilled	$0.705	$35.41	50.2
Unskilled	$0.496	$25.30	51.0
Inside maintenance—			
Skilled	$0.708	$36.21	51.1
Unskilled	$0.486	$23.51	48.4
Outside—			
Skilled	$0.698	$35.82	51.3
Unskilled	$0.473	$22.59	47.7
All classes—			
Skilled	$0.703	$35.69	50.8
Unskilled	$0.482	$23.42	48.6
All wage earners—	$0.635	$32.36	50.1

The Leipzig Fair Directory.

The autumn edition for 1929 of the official Leipzig Fair Directory is now available and can be obtained from Verlagsanstalt des Leipziger Messamts G.m.b.H., Flossplatz 6, Leipzig, C.1. This directory contained 20,000 entries of firms and specifications of their manufactures. In addition, convenient special editions are issued for buyers in special lines. The price of the Sample Fair Directory is R.M. 5, and of the Technical and Building Fair, R.M. 2.6.

Unemployment.

An increase of 31,457 in the number of registered unemployed persons was recorded during the week ended July 29th. At that date the total was 1,154,100, as compared with 1,122,643 on July 22nd, and 1,304,971 on July 30th, 1928.

New French Companies.

Among the new companies recently formed in France are the Société de la Traction Electrique Moderne, Lyons (32, Rue Victor Hugo), capital one million fr., and La Société du Materiel Electrique S.W. Paris (42, Rue d'Anjou), capital 100 million fr. The last-named concern has been formed to exploit the recent agreement between the Schneider Co., of Le Creusot, and the Westinghouse Electric & Manufacturing Co., of Pittsburgh, U.S.A.

German Glow Lamp Exports.

Although no reliable information has hitherto been forthcoming concerning the understanding recently reached between the American General Electric Company and the German Osram Company, it is stated that the development of the German exports of glow lamps seems to point to the circumstance that German-American sales agreements were entered into at the beginning of this year. In the first half of 1927 Germany exported 446,000 metal filament lamps to the United States and 342,000 lamps in the first half of 1928, whereas in the same period in the present year the United States no longer appear in the German export statistics as purchasers of glow lamps. Mexico imported from Germany in January-June, 1927, 622,000 metal-filament lamps and 1,391,000 lamps in the first half of 1928, but only 12,300 lamps in the first six months of 1929. Despite the loss of the United States and Mexican markets, the exports of German wire filament lamps have increased from 18,833,000 in the first half of 1927 to 26,785,000, and further to 29,907,000 lamps in the same periods of 1928 and 1929 respectively. The corresponding values are given as 9,371,000 marks, 14,545,000 marks and 15,668,000 marks in the three half years respectively. It is noted that only Italy and Great Britain purchased fewer lamps this year than in the first half of 1928.

Glasgow Corporation and Research.

The Glasgow Corporation Electricity Committee has recommended that a grant of £100 be made to the funds of the British Electrical and Allied Industries Research Association. It also recommended that the annual subscription of £21 to the funds of the British Engineering Standards Association be renewed for the year.

Social Event.

Messrs. Siemens Lamp Works staff entertained members of the Preston Corporation Electricity Department at Ashton Park on July 25th. Matches at golf and bowls provided some very close games, and resulted in wins for Siemens by 4½ matches to 2½ at golf and 5 matches to 3 at bowls. An impromptu smoking concert which followed completed a very enjoyable evening.

New Swiss Company.

A new company has recently been formed in Geneva (8, Place du Molard) with the title of the Compagnie Generale de Brevets Pouchain to acquire and exploit the world's rights in certain patents in electric accumulators taken out by Signor Adolphe Pouchain, of Turin.

New Lighting Glassware.

Messrs. John Shaw & Sons, Wolverhampton, Ltd., have arranged comprehensive displays of new season's glassware at their head office showrooms and at their London showrooms, 9-30, Shoe Lane, E.C.4. The accompanying picture shows a

Lighting Glassware displayed by Messrs. John Shaw and Sons.

selection of the new glassware at the Wolverhampton showrooms. The range includes all the latest shapes and designs, both plain and decorated. Panel fittings and enclosed units are included in the display.

Bankruptcy Proceedings.

J. L. Whiting, electrical engineer and contractor, 4, Portland Street, Newark.—First meeting, August 14th, at the Official Receiver's office, 22, Regent Street, Park Row, Nottingham. Public examination, October 3rd, at the Court House, Nottingham.

F. Whittle, electrician, 41, Mawdsley Street, Bolton.—Receiving order made July 31st on debtor's own petition. First meeting August 16th, and public examination September 17th, both at the Court House, Mawdsley Street, Bolton.

K. E. Wheeler (trading as Wheeler & Sons), engineer, 96, Adelaide Road, Hampstead.—Last day for proofs for dividend, August 24th. Trustee, Mr. F. W. Davis, 28, Theobald's Road, W.C.

Sewell & Brown, electrical and radio engineers, 6a, The Exchange, Muswell Hill.—First and final dividend of 2s. in the £, payable at Bankruptcy Buildings, Carey Street, W.C.

S. J. Sewell (separate estate).—First and final dividend of 7s. 6d. in the £, payable at Bankruptcy Buildings, Carey Street, W.C.

C. R. Tarver, electrical engineer, 16, Forrest Street, Cardiff.—Discharge suspended for six months until January 2nd.

Col. Tempest, Nursery House, Clayton Heights, Clayton.—Trustee, R. Lindley, appointed July 29th.

H. V. Charley (trading as Dinas Powis Electrical Supply Co.), 31, Greenfield Avenue, Dinas Powis.—Last day for proofs of dividend, August 17th. Trustee, Mr. O. Ellis, Official Receiver, 34, Park Place, Cardiff.

Company Liquidations.

J. L. Gottlieb & Co., Ltd., electrical wire manufacturers, late Cromer Street, W.C.—A meeting of the creditors was held on August 6th at Salisbury House, London Wall, E.C., when Mr. F. F. Sharles, the liquidator, presided. Mr. Sharles stated that the meeting was purely a formal one, as all the debts of the company had been, or would be, paid in full, but the meeting was necessary to comply with the Companies Acts. The chairman stated that there had been an amalgamation of Messrs. Gottlieb's business with another concern, and the whole had more recently been taken over by Aeonic Radio, Ltd. With regard to the present position, the unsecured creditors' claims, apart from a claim for income tax, amounted to £502, against which there were book debts put down at £3,479, which were estimated to be worth £1,200; cash in hand £56, and cash at bank £191. There was a surplus of assets over liabilities of £955. With regard to the claim for income tax this amounted to £600, or thereabouts, but for the moment the claim was disputed. It was decided to leave the matter in the hands of the present liquidator.

Albany Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. D. C. Cann, Eldon Street House, Eldon Street, E.C.2. A meeting of creditors is called for August 16th at Winchester House, Room 23, Old Broad Street, E.C.2. Particulars of claims to be sent to the liquidator by September 30th.

Ingham Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. H. Curry, 8, Beech Grove, Undercliffe, Bradford. A meeting of creditors was called for August 9th at the company's offices, 34, Union Street, Bradford. Particulars of claims to be sent to the liquidator by August 31st.

Electric Factors (Blackpool), Ltd.—Particulars of claims to be sent to Mr. J. Todd, liquidator, 18, Birley Street, Blackpool, by September 22nd.

Brunswick Engineering Co., Ltd.—A meeting of members is called for September 9th at 32, Finsbury Square, E.C.2, for the purpose of having an account laid before them by Mr. H. C. Merrett, the liquidator, showing the manner in which the winding-up of the company has been conducted, and the property disposed of.

Recovery of Hire-purchase Instalments.

The Glasgow Corporation Electricity Sub-Committee on Finance has received a report from the town clerk regarding the recovery of unpaid instalments under hire-purchase schemes in connection with the domestic wiring of houses, in cases where a tenant leaves his house prior to the date of expiry of the agreement, and the incoming tenant refuses to take over the obligations under the agreement, and has instructed the town clerk (1) to arrange a meeting with the House Factors Association on the subject; and (2) to take proceedings, if necessary, for the recovery of instalments outstanding.

Ceylon Electrical Imports.

The *Times Trade and Engineering Supplement* reports that developments in the supply of electricity have resulted in increased requests for electrical equipment and machinery, and electric control and switchgear, generators, alternators and dynamos, motors, transformers and convertors, and other electrical machinery have a good sale. Imports are almost entirely from Great Britain. Electric wires, cables, telephone and telegraph instruments and appliances are in strong demand, British lines controlling the trade. Imports of electric lighting accessories and fittings, including switches, were valued at Rs. 603,252 in 1928, as compared with Rs. 442,068 in the preceding year. The trade is largely in British products, but competition from the United States, Germany, and Holland is very keen and merits close attention. Other electrical goods, imports of which were valued at Rs. 627,599 in 1928, are obtained mainly from the United Kingdom. There is a growing demand for household electrical appliances. Small electric power sets have a sale on the estates.

New Catalogues and Lists.

Autocar Electrical Equipment Co., Ltd., 115, Old Street, E.C.1.—A price list for rewinding dynamos and starting motor armatures.

Messrs. Ernest F. Moy, Ltd., Greenland Place, Camden Town, N.W.1.—A leaflet giving particulars of portable resistance, type No. 154. Illustrated and priced.

Messrs. Cunningham, Ltd., 169-171, Edgware Road, W.2.—A pamphlet advertising portable wireless sets.

Ateliers de Constructions Electriques de Charleroi.—August stock list of a.c. motors, transformers, &c. Illustrated.

Messrs. Turner Brothers Asbestos Co., Ltd., Rochdale, England.—A booklet illustrating "Sindanyo" manufactures of many switchgear firms; a folder describing "Sindanyo" insulating board; a price list of "Sindanyo" boards; and a folder depicting N.P.L. tests on "Sindanyo" board.

British Aluminium Co., Ltd., Adelaide House, King William Street, E.C.4.—A booklet entitled "Light Alloys in Industry," indicating a few typical applications of these alloys in various industries. A number of excellent illustrations are included.

Messrs. Siemens Brothers & Co., Ltd., Woolwich, S.E.18.—Pamphlet No. 508 A and 510 A describing, respectively, the "Neophone" telephone, and the small rural automatic exchange equipment No. 26, which has a capacity of 50 lines.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—"'Bus bodies and trolley 'buses"; an illustrated booklet describing these products.

Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, W.C.2.—An illustrated brochure dealing with the company's public address equipments.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—A folder illustrating the firm's showrooms at Australia

House, Strand, W.C.2, and inviting inspection. Also a card giving a list of the company's various current publications on electric control gear.

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—Price lists Nos. 217/1 and 218/1, drawing attention to d.c. motor starters of from 7½ to 100 h.p. Illustrated.

Messrs. S. G. Leach & Co., Ltd., 26-30, Artillery Lane, E.1.—Price list No. N.S.108, advertising the H.B. drink mixers and heaters.

Sternol, Ltd., Royal London House, Finsbury Square, E.C.2.—Two illustrated folders dealing with "Chainoleum" lubricant for chain drives and "Cooloricid" for the prevention of overheated bearings.

Standard Wet Battery Co., 184-188, Shaftesbury Avenue, W.C.2.—Illustrated and priced leaflets advertising "Standard" wet batteries and Wate's "Star" loudspeaker units and radio testing apparatus.

Electrical Equipment & Carbon Co., Ltd., Bank Buildings, 107/111, New Oxford Street, W.C.1.—Illustrated and priced pamphlets showing the "Mignon" electric drilling machine and the "Aerosan" air purifier.

British Insulated Cables, Ltd., Prescot, Lancs.—Publications Nos. P.F. 57, and H. 117, dealing respectively with Prescot lead joint boxes and Leclanche batteries. Also brochure drawing attention to the Helsby twin wiring system, with illustrations of the various types of buildings in which the system has been installed.

Houghton-Butcher (Great Britain), Ltd., High Holborn, W.C.1.—A summer price list of radio receiving sets and accessories.

Electric Heating Co., George Street, Croydon.—Catalogue for the season 1929-30 of the company's heating and cooking appliances. Fully illustrated and priced.

Trade Announcements.

Mr. F. L. Smith, electrical contractor, has transferred his business from 405, Doncaster Road, Rotherham, to Stanley Street, The Crofts, Rotherham.

The Carwin Electric Co., of Preston, has opened a new branch establishment in Cleveleys Avenue, Cleveleys-on-Sea, Lancs.

Mr. Alan Wright has changed his address from 124, Chancery Lane, W.C., to 117, Victoria Street, S.W.1.

A New Merger.

The businesses of the Welsbach Light Co., Ltd., of Gray's Inn Road, W.C.1, and Lighting Trades, Ltd., of 30-31, Farringdon Street, E.C.4, which are both controlled by Imperial Chemical Industries, Ltd., have now been concentrated at the address of Lighting Trades, Ltd. New stores have been built to accommodate the lighting and heating apparatus for gas, electricity and oil, resulting from the concentration of stocks of the two companies, and particular attention has been paid in the planning to facilitate rapid collection and despatching of goods.

Electric Furnace Company's Acquisition.

Reuter's Cologne correspondent reports that it is stated that the Electric Furnace Co., Ltd., of London, has acquired from the German firm of Hirsch Kupfer und Messingwerksgesellschaft the English and French patent rights for the manufacture of electric resistance furnaces, according to the latter firm's process. Under the agreement with the German firm the company's "territory" will include, in addition to England and France, Belgium and the English Crown colonies.

For Sale.

The West Midlands Joint Electricity Authority has for disposal three turbo-alternators and six boilers with all auxiliary plant and pipework. (See our advertisement pages to-day.)

Hospital Electricity Supply.

The rewiring of 26 wards at Whipps Cross Hospital is being undertaken by the General Installation Co., Ltd.

Meeting of Creditors.

Meetings were held on August 7th of the creditors of Messrs. Clayton & Shuttleworth, Ltd., and of its subsidiary, Clayton Wagons, Ltd., at which Sir William McClintock, the receiver for the debenture holders, submitted a statement of affairs. He stated that when the company lost its market for agricultural machinery it turned its attention to the manufacture of water-tube boilers, railway carriages and wagons. At the moment nothing was being done at the works of the company. They were skeleton works, and most of the plant and stocks required for the manufacture of the agricultural implements had been transferred to Clayton Wagons, Ltd. Nothing would be gained by Clayton & Shuttleworth, Ltd., going into liquidation. The goodwill was of value, and the future depended upon the arrangements which could be made with Clayton Wagons, Ltd. The creditors decided to appoint a committee to confer with the receiver.

Book Notices.

Publications of the National Electric Light Association.—Serial report of the Rural Service Committee; Developing electric service for the farm (25 cents). Serial report of the Industrial Relations Committee; Training for better public contact-building and conducting the training programme.

"*Journal* of the Institution of Engineers, Australia." Vol. I. No. 6, June, 1929. Sydney (N.S.W.): The Institution. Price 7s. 6d.

"*Journal* of the Institute of Transport." Vol. X, No. 9 (complete with index). London: The Institute. Price to non-members, £1 1s.

The French Ministry of Public Works (central office of hydraulic power and electrical energy distribution) has published statistics of the production (by water-power and steam-driven stations) and distribution of electricity throughout France (July, 1928). It has also issued a map showing the high-voltage (over 60,000 V) transmission lines that are in use.

"Laboratory Notes for Electrical Engineering Students," by A. R. Nissar. Second edition. Calcutta: The I.S.S.D. (Macmillan & Co., Ltd.). Price 2 rupees.

New Municipal Showrooms.

Colchester Corporation is to adapt premises in the High Street at a cost of £525 for electricity showrooms.

G.E.C. Swimming Success.

In a team race between the G.E.C. swimming team and Messrs. Kodak, held recently, the G.E.C. team scored a meritorious victory. This followed its recent success at Highgate Ponds in the West End business houses open 500 yards event.

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during July, 1929.

	July, 1929. £	Inc. or Dec. as compared with July, 1928. £	7 months, 1929, Inc. or Dec. £
Imports.			
Electrical goods and apparatuds	451,023	+ 115,669	+ 595,514
Machinery	1,686,835	+ 226,145	+1,238,562
(including electrical machinery) ...	138,046	– 12,205	+ 5,551
Exports.			
Electrical goods and apparatus	1,187,002	+ 322,639	+ 529,439
Machinery	5,066,387	+ 499,156	– 230,735
(including electrical machinery)	516,314	– 30,303	– 257,025
Re-exports.			
Electrical goods and apparatus	23,078	+ 10,928	+ 21,125
Machinery	168,202	+ 21,368	+ 2,274
(including electrical machinery)	9,616	– 1,711	– 16,510

Recent Contracts.

The Croydon Corporation has awarded a contract to the English Electric Co., Ltd., for the complete equipment of a new switch house at its power station. The installation, which is to the designs and specification of Mr. A. C. Cramb, the borough electrical engineer, will include electrically-operated compound-filled switchgear of high-rupturing capacity with a special arrangement of duplicate busbars. It will form the main control for the turbo-alternator plant including a new 25,000-kW set, and for group feeders to the existing feeder switchgear. The contract, valued at £44,300, is a comprehensive one, including reactors, synchronising gear, and control boards, telegraphs, telephones and multi-core cable, earthing equipment, &c., and will be carried out at the company's Stafford works.

Among the orders recently received by Messrs. E. J. Walsh and Co. are the following:—Three complete double-deck tramcars for Preston Corporation; 200 steel poles for Hull Corporation; eight tramcar motors for Dublin United Tramways; and various equipment for Wemyss & District Tramways, South Shields, Edinburgh, and Middlesbrough Corporations.

Included in a number of orders received recently by the Hart Accumulator Co., Ltd., is one from H.M. Office of Works for a battery consisting of 120 "STC.17" type cells having a capacity of 800 ampere-hours, to be installed in the Admiralty Research Laboratory at Teddington.

The Post Office has placed an order with Messrs. Siemens Brothers & Co., Ltd., for 50,000 "Neophone" telephone instruments.

It has been decided to install the latest type of "Yarrow" water-tube boilers in the fast passenger and cargo vessels now being constructed by Cammell, Laird & Co., Ltd., for the Canadian National Railways Company, under the supervision of A. T. Wall & Co., consulting naval architects, Liverpool. Each vessel will have six "Yarrow" boilers equipped with "Yarrow" superheaters and "Yarrow" airheaters. Messrs. Yarrow & Co., Ltd., are constructing the whole of the boiler installation for the first vessel, and are supplying working drawings to enable Cammell, Laird & Co. to build the boilers for the other two vessels.

Prices of Materials.

Messrs. James Forster & Co. report that the position of lead is unchanged, supply and demand being very evenly balanced with the latter showing a slight tendency to increase. Arrivals are expected to be rather short this month, although not excessively so, but with 19,000 tons reported to have been shipped from Australia in July, next month should see fuller supplies. The future very much depends upon what effect the probable raising of the Bank of England rate will have on consumption. Should it have no effect, a quick recovery from present levels is anticipated.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, August 13th: No change in copper prices.

Messrs. James & Shakespeare report, August 13th: English pig lead, £24 10s., 5s. dec.

Messrs. Edward Till & Co. report, August 13th: India-rubber, Para fine, 11¼d., ¼d. inc.

Lighting and Power Notes.

Ashford (Kent).—LOAN.—The Urban District Council has applied for sanction to a loan of £2,084 for electricity extensions in the East Ashford rural district.

Barking.—LOAN.—The Urban District Council has applied for sanction to the borrowing of £17,800 in respect of the sub-station, switchgear, cable, &c., required in connection with the supply of electricity to the L.C.C.'s Becontree Estate.

MAINS EXTENSIONS.—The Urban District Council Electricity Committee has passed the estimate of £6,715 in connection with the suggested extension of electricity mains to Messrs. Warne's, the sewage works, and Messrs Gross, Sherwood and Heald, and has agreed to extensions of mains to supply electricity to the Greatfields Estate, at an estimated cost of £2,400.

Barnstaple.—YEAR'S WORKING.—There was a profit of £1,929 on the Corporation electricity undertaking during the past year, as compared with £56 in the previous year and a loss of £1,255 three years ago. The number of consumers has increased to 1,265, and the sales of electricity per head of the population to 53.1 kWh.

Barrow-in-Furness.—YEAR'S WORKING.—The report on the working of the Corporation Electricity Department (engineer: Mr. H. R. Burnett) for the year ended March 31st last shows a total revenue of £109,091, as compared with £111,122 the previous year. Working expenses totalled £64,719, as against £66,181, leaving a gross profit of £44,372 (£44,941). An unemployment grant was added to the gross profit, making a sum of £44,555 available, and after provision had been made for interest on loans and contributions to sinking fund, there remained a net surplus of £13,113, as compared with £14,035 in 1927-28. The capital expenditure during the year amounted to £77,322, the largest item being £52,106 for machinery and plant. The sales of electricity increased from 16,635,404 to 17,700,214 kWh, but the maximum supply demanded fell from 5,800 to 5,700 kW. The average price obtained for private lighting and domestic supply was 3.62d. and for the whole supply 1.40d. per kWh. A reduction of ¼d. per kWh was made on April 1st, 1928.

Barming.—HOSPITAL LIGHTING.—Kent C.C. is to install electric lighting at the mental hospital, at an estimated cost of £8,500.

Bath.—YEAR'S WORKING.—The accounts of the city electricity undertaking (engineer, Mr. J. W. Spark) for the year ended March 31st last record a total revenue of £97,234 and a working expenditure of £45,011, leaving a gross profit of £52,223. The figures for the preceding year were: Income, £86,091; working expenses, £41,100; gross profit, £44,991. After providing for capital and other charges, there was a net surplus of £8,713, as compared with £8,205 in 1927-28. The capital expenditure during the year amounted to £28,036, and included £16,566 for mains and services. The sales of electricity increased from 8,759,087 to 12,556,735 kWh, and the maximum supply demanded from 5,440 to 6,450 kW.

Bedford.—OVERHEAD LINES.—The Bedford Electricity Committee has agreed to carry overhead lines to the Marston Valley Brick Co., Lidlington, and to the Great Farm House, through Silsoe Road, Maulden. The Ampthill Rural District Council is not to offer objection to either of these extensions.

Berkhamsted.—OVERHEAD LINE.—The Rural District Council has decided to offer no objection to the proposed overhead line which is to transmit electricity from Luton to Aylesbury.

Bicester.—ELECTRICITY SUPPLY.—In connection with the supply of electricity to Bicester, the Wessex Electricity Supply Co. proposes to give a supply to Kidlington, where a number of houses are being constructed, by next Christmas.

Birmingham.—HAMS HALL INAUGURATION.—The Duke and Duchess of York are to visit Birmingham on November 6th to officially open the city's new electricity generating station, which has been erected as a cost of £3,500,000.

Bolivia.—HYDRO-ELECTRIC DEVELOPMENTS.—In order to increase the supply of hydro-electrical power for industrial purposes, the Administration has granted a concession to the Bolivian Power Co. for the utilisation of the Zongo Falls. Plans will be submitted shortly to the authorities for a large dam and plant capable of developing 30,000 h.p. The concessionaires also undertake to build a motor road connecting Zongo with Canaviri and La Paz. On completion of the first dam, at Achachicala, a second reservoir will be commenced on a high plateau near the former plant and an additional turbine installed. Permission has been given to run transmission lines over a defined area and to install an automatic telephone system, provided the municipal government offers no opposition.—*Reuter's Trade Service* (La Paz).

Bolton.—ADDITIONAL ELECTRICITY SUPPLY.—At a recent meeting of the Corporation Electricity Committee, the borough electrical engineer reported on the system of distribution of electricity in the central area of the borough, and submitted a scheme by which the additional supply required would, within a radius of approximately a quarter of a mile from the town hall, be afforded by means of three-phase a.c. of standard frequency and pressures. The proposed scheme also provided for the gradual change-over of the existing d.c. system of distribution within the area mentioned to a.c., as technical and financial considerations and other circumstances might render it advisable. An estimate of the cost of providing the necessary sub-stations and works required for putting into operation the proposed scheme was submitted and the proposed scheme approved.

Colchester.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to loans of £7,500 for domestic apparatus for hire, and £7,500 for wiring installations.

Continental.—RUSSIA.—Owing to the great increase in demand for power supply in the Moscow district, plans are being prepared for a new 300,000-kW generating station to be erected at Bobriki, near Moscow. It is intended to install four 75,000-kW turbo-generators. Pulverised fuel is to be used for the boilers.

LUXEMBURG.—During the past six months the Compagnie Luxembourgeoise d'Electricité has extended its distribution mains to eleven more communities. Out of the 185 small towns in the company's area, 101, with a total population of 67,805, are now being supplied with electricity for lighting and power purposes.

FRANCE.—Le Société d'Union Hydroélectrique, of Paris, has recently secured a concession to establish a hydro-electric station to utilise the water power of the River Creuse, near Roche-aux-Moines, in the Indre Department.

Work is in hand on the linking up of the power station of the Société de l'Electricité de la Seine at Ivry with that of the Société de l'Electricité de Paris at St. Denis. The work includes the establishment of a large new transformer station at Conflans.

Eastbourne.—COOKER RENT REDUCTION.—At a recent meeting of the Corporation Electricity Committee, the electrical engineer reported that owing to the recent great improvement in equipment, design, and finish of electric cookers, it was now a difficult matter to place out on hire cookers that had been returned after use. His suggestion that the rent for the earlier pattern cookers should be reduced to 2s. 6d. for small and 4s. for large cookers per quarter was adopted.

LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £9,496 in connection with works required for the supply of electricity to Willingdon and Wannock.

NEW FEEDER.—The Corporation Electricity Committee has decided to lay an 11,000-V feeder to a new sub-station to be erected to complete the ring main, at a cost of £13,550.

Formby.—WIRING SCHEME.—The Urban District Council has adopted a scheme for the free wiring of houses, under which the flat rate charges will be ¼d. per kWh above the rate for ordinary meters. Electric motors, radiators, kettles, and small cookers are to be let out on hire.

Glasgow.—MAINS EXTENSIONS.—The Corporation Electricity Committee has authorised mains extensions at a cost of £6,600.

NEW SWITCHGEAR.—The Corporation Electricity Committee has approved the installation in various sub-stations of Reyrolle switchgear at a cost of £3,000.

WIRING SCHEME.—Under the Corporation Electricity Department's wiring scheme 650 houses were wired in June, making the total to date 15,105. Appliances let out on hire numbered 15, making the total 18,403.

Gloucester.—LOAN.—The City Council has applied for sanction to a loan of £7,000 to meet the estimated cost of laying a.c. mains in place of d.c. mains in a portion of the city.

Great Yarmouth.—YEAR'S WORKING.—A total revenue of £92,387, as against £81,860 for the preceding year, is recorded in the statement of accounts of the Corporation electricity undertaking (engineer, Mr. P. G. Campling) for the year ended March 31st last. Working expenses decreased from £33,900 to £32,888, leaving a gross profit of £59,499, as compared with £47,960 in the previous year. Income from other sources was added to the gross profit, making a total of £64,382 available, and after providing for capital and other charges, there remained a net surplus of £6,066, as against £8,773 in 1927-28. The capital expenditure during the year amounted to £134,914, of which £57,080 was spent on mains and services and £44,785 on machinery. The sales of electrical energy increased from 5,673,627 to 8,546,276 kWh, and the maximum supply demanded from 3,850 to 5,730 kW.

Greenock.—EXPLOSION.—An explosion which occurred at the Main Street sub-station of the Corporation on August 7th blew out the front of the building and blocked the main thoroughfare with the débris.

Hastings.—YEAR'S WORKING.—We have received from Mr. A. J. Ryan, borough electrical engineer, a statement of accounts of the Corporation Electricity Department for the twelve months ended March 31st last. The total revenue increased from £100,699 to £121,855 and the working expenditure from £50,190 to £52,714, leaving a gross profit of £69,141 (£50,509). To the gross profit was added income from other sources, making a total of £72,263 available. After providing for capital charges, there was a net surplus of £24,092, as compared with £10,972 in 1927-28. The sales of electricity increased from 10,574,800 to 13,828,042 kWh, and the maximum supply demanded from 6,550 to 8,550 kW. The average price obtained per kWh fell from 2.168d. to 1.965d. An additional 6,250 kW turbo-alternator and an additional 30,000 lb. water-tube boiler unit were installed at the Broomgrove power station, and the original cooling towers and reinforced concrete tanks were remodelled. Supplies of electricity were made available during the year in Rye, Winchelsea, Battle, Broad Oak, Brede, Water Farm, Pett, and Icklesham, and it is anticipated that a supply will be available in the remaining villages included in the original scheme, *viz.*, Beckley, Northiam, Sedlescombe, and Westfield, during the current year.

Hatton.—INQUIRY.—Lieut.-Col. Tucker held a Ministry of Transport inquiry recently into the application of the Derbyshire and Nottinghamshire Electric Power Co., for leave to erect an overhead line at various points in the district. For the applicants, Mr. Wallis stated that 36 out of 38 owners of land had consented to the erection of the necessary poles. The company offered to pay 4s. per annum as wayleave, but the owner asked 14s. He added that the much-desired electrification of the rural districts would be hampered and the costs increased under heavy payments for wayleave. The engineer was asked if it would not be possible to lay the cable underground, but he replied that the cost incurred thereby would be increased threefold. It was objected that the erection of poles would be a serious handicap in mowing pastures, and amenities would be diminished.

Hebden Bridge.—LOAN.—The Urban District Council has decided to apply for sanction to the borrowing of £6,000 for electricity purposes.

Hull.—BULK SUPPLY.—The Corporation Electricity Committee is to arrange for a bulk supply to the Whiting works of Messrs. Storry, Witty & Co., Ltd., near Beverley, at a cost of £6,370.

Irish Free State.—CHARLEVILLE.—The Electricity Supply Board has made an offer to purchase the electricity undertaking from the Charleville Electric Co., Ltd., for the sum of £1,350. This offer has been made as the result of an inspection of the plant and premises by a representative of the Board. As the offer is subject to acceptance by the company's shareholders, no arrangements have yet been made for the taking over of the concern. For the year ended June 30th, 1928, a dividend of 10 per cent. was paid, and it is thought that a similar dividend can be paid for the year ended June 30th, 1929.

Lindsey.—ELECTRICITY SUPPLY.—It was reported at a recent meeting of the County Council that the clerk had interviewed representatives of the Yorkshire Electric Power Co., Mr. R. Borlase Matthews, and an official of the Electricity Commissioners regarding the supply of electricity in Lincolnshire. The Electricity Commissioners were proceeding with the preparation of the Orders to give effect to their decision as to the areas to be allotted to the Yorkshire Electric Power Co. and Mr. Matthews, respectively. Both parties had decided to accept the decision of the Commissioners, and there would be no appeal to the Ministry of Transport. The draft Orders would be available at an early date, and the County Council and local authorities would have an opportunity of making representations with regard thereto. So far as the Lindsey portion of Mr. Matthews' area was concerned, it was the intention to put down a temporary plant at Skegness to enable him to give a supply of electricity by the autumn of 1930.

Liverpool.—LOAN.—The City Council at a recent meeting decided to make application for sanction to a loan of £35,700 in respect of engineering fees in connection with the erection of the Clarence Dock generating station. It was also decided to make the city electrical engineer a payment of £700 per annum out of these fees during the construction of the station, for a period not exceeding two years.

NEW ELECTRICITY CHARGE.—The City Council has approved the adoption of a new alternative tariff for electricity for business premises such as retail shops, hotels and premises of a like nature combined with private houses. There will be a fixed quarterly charge of £4 per kW, based on the total wattage of the lamps installed, plus ½d. per kWh. This scale will only apply to premises solely lighted by electricity.

YEAR'S WORKING.—In the annual report of the city electrical engineer, Mr. P. J. Robinson, on the working of the electricity undertaking, it is stated that the sales of electricity for the year ended March 31st last were 246,019,043 kWh, as compared with 223,641,672 kWh in the preceding year. The maximum supply demanded also showed an increase from 89,600 to 93,700 kW, and the total number of connections for all purposes, excluding tramways, rose from 144,662 to 163,251 kW. Considerable progress was made in the use of apparatus for domestic purposes, including hot water supply, electric cookers and heating appliances in private houses. At the present time over 3,600 cookers are in use. The average price received per kWh for all purposes was 1.282d. The area of supply now covers the whole of the city of Liverpool, the borough of Bootle, the urban districts of Litherland, Waterloo-with-Seaforth, and Great Crosby and Little Crosby, a total of over 51 sq. miles. In addition a bulk supply is given from the Aintree sub-station to the West Lancashire Rural District Council for the purpose of supplying Maghull and Lydiate. A bulk supply is also given to the British Insulated Cables, Ltd., at Prescot, who are the authorised undertakers for the Prescot, Roby and Huyton districts. The Lister Drive stations and the proposed Clarence Dock station are now scheduled as "selected stations" in connection with the North-Western Area Electricity Scheme. The Clarence Dock site was formally taken over on March 26th last. The sheds on the estate, as far as required for the erection of the station at this stage, have been demolished. The dock has been drained, and the bottom has been found to be very hard and highly suitable for the foundations of the buildings to be erected on it. Tenders have been accepted for the first 50,000 kW turbo-alternator and also for the turbine house crane. It is anticipated that the building work will be commenced by August next, and will be completed in time for the putting into operation of the first part of the station at the end of 1930 or the beginning of 1931.

PUBLIC LIGHTING.—The report on the public lighting of the city for the year ended March 31st last shows that the total length of roads lighted by electricity increased during the year from 151 to 174 miles, and the number of electric lamps from 8,555 to 9,766. The gross expenditure of the City Lighting Department amounted to £123,369, and a revenue of £14,061 was obtained from work performed for and material supplied to other departments and committees, making the net capital expenditure on public lighting £109,310.

Lytham St. Annes.—BULK SUPPLY.—The Corporation has appointed a special sub-committee to negotiate with the Preston Corporation for obtaining a bulk supply of electricity.

Newcastle-under-Lyme.—YEAR'S WORKING.—The statement of accounts of the Corporation Electricity Supply Department for the year ended March 31st last shows a total revenue of £15,055 and a working expenditure of £7,716, leaving a gross profit of £7,339. The figures for the preceding year were: Income, £13,387; working expenses, £7,795; gross profit, £5,592. To the gross profit was added an unemployment grant, making available a sum of £7,397, and after providing for capital and other charges, there was a net surplus of £2,506, as compared with £197 the previous year. The electrical energy sold increased from 760,709 to 840,098 kWh.

Newport (Mon.).—YEAR'S WORKING.—The report on the working of the Corporation electricity undertaking (general manager, Mr. N. J. Young; borough electrical engineer, Mr. A. Nicholls Moore) for the year ended March 31st last shows a total revenue of £192,657, as compared with £191,111 the preceding year. Working expenses decreased from £102,578 to £100,622, leaving a gross profit of £92,035, as against £88,533. To the gross profit was added income from other sources, making a total of £96,735 available. After payment of capital and other charges, there was a net profit of £16,029, as compared with £29,050 in 1927-28. A contribution of £9,500 was made to the relief of rates. The capital expenditure during the year amounted to £207,186, the principal items being £46,818 for lands and buildings; £78,346 for machinery, and £31,416 for mains. The sales of electrical energy increased from 28,461,013 to 32,831,179 kWh, and the maximum supply demanded from 11,350 to 12,975 kW. The average price obtained per kWh fell from 1.487d. to 1.297d. During the year the major extensions at the East power station were practically completed, the new 10,000 kW turbo-alternator and the new boiler units being put into commission. The Llanarth Street works, which had for several months been used for a stand-by generating station, was definitely closed down for generating purposes on January 1st last. The assisted wiring scheme showed increasing popularity, the total installations connected at March 31st being 3,742, an increase of 1,464 during the year.

Northern Ireland.—LETTERKENNY, CO. DONEGAL.—The town clerk has received a letter from Mr. Eugene O'Doherty, informing him that the town is to have a supply of electricity for the coming winter. Mr. O'Doherty stated that he had been informed by the Electricity Supply Board that it hoped to have a plant suitable for the lighting of Letterkenny installed by about October next. The Board is to manage the undertaking, and is only waiting to find a plant for the purpose in the systems in the Irish Free State which it is taking over. The Board is also to set up a scheme for the whole of the County Donegal in the coming spring.

OMAGH (CO. TYRONE).—At the monthly meeting of the Urban District Council, the agreement for the purchase of the site for the new generating station was signed, and a memorial to the Electricity Commissioners and the Ministry of Commerce on behalf of the proposed new scheme was passed and ordered to be presented.

BALLYMENA (CO. ANTRIM).—The Urban District Council has decided to apply to the Electricity Commissioners for an Order to proceed with an electricity scheme in the urban area.

Northiam.—ELECTRICITY SUPPLY AGREEMENT.—The Hastings Town Council has agreed to pay an *ex-gratia* sum of £500 to Messrs. C. J. Bannister & Son, who have been supplying elec-

tricity to consumers at Northiam, as compensation in respect of their plant and goodwill of the undertaking. The plant is to remain the property of the firm, whose supply in the parish will be discontinued as from October 1st next. The firm will, however, continue to supply the east end of the parish until the Council is in a position to do so, but in any case not later than October 1st, 1931.

Oldham.—POWER STATION INAUGURATION.—The Corporation Electricity Committee has arranged for the formal opening of the new power station to take place in October next, and is to invite Sir Andrew Duncan to be present as the chief guest.

LOAN.—The committee is to seek sanction to a loan of £50,000 for mains extensions.

Portland.—ELECTRICITY CHARGES.—In connection with the forthcoming electricity scheme, the Urban District Council has fixed the charge for electricity for lighting at 8d. per kWh, and for all other purposes at 3d. per kWh.

Price Reductions.—The following reductions in the charges for electricity have been made or recommended in the following districts:—

MAIDENHEAD.—Lighting flat rate: A reduction of 1d. per kWh. High rate charge under maximum demand system: A reduction of 2d. per kWh. Fixed annual charges under the two-part tariff for business consumers: A reduction of 5 per cent. on the first £10 of the fixed charge, 10 per cent. on next £30, and 20 per cent. on the remainder. Power on special contracts: A rebate of 10 per cent. Prepayment two-part tariff for private consumers: A rebate of 1d. in the 1s.

NEWCASTLE-UNDER-LYME.—Flat rate for lighting: From 6d. to 5½d. per kWh. Ordinary heating and cooking rate: After the first 480 kWh per quarter the charge to be 1½d. per kWh. The "unit" charge for lighting, heating and other domestic supplies in connection with the multi-part tariff: After the first 480 kWh per quarter, the charge to be ¾d. per kWh, and, where a low-loaded, thermostatically-controlled water heating system is installed, ½d. per kWh. Late shop-window lighting where an undertaking is given to take supply for not less than three hours per night between October 1st and March 31st: A flat rate of 1½d. per kWh.

PERTH.—Lighting: A reduction of ½d. per kWh, making the scale of charges 3½d. to 3d., as against 3¾d. to 3½d. Power: a reduction of 20 per cent.

Ripon.—INAUGURATION OF NEW SUPPLY.—The formal ceremony of switching on the new supply of electricity of the Corporation electricity undertaking was performed on August 7th. Under the new scheme, which has cost about £2,000, a bulk supply is purchased from Harrogate at a pressure of 11,000 V.

Rochdale.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer, Mr. F. A. Rudd) for the twelve months ended March 31st last record a total income of £284,643, and working expenditure of £222,268, leaving a gross profit of £62,375, to which was added a grant from the Unemployment Grants Committee, making a total of £63,256 available. Loan interest, sinking fund, &c., absorbed £56,253, leaving a net surplus of £7,002. The revenue from the hire and hire-purchase of domestic appliances increased from £1,724 to £3,305. The capital expenditure during the year amounted to £53,913, and was wholly spent on extensions to the mains and distributing systems. Electrical energy sold increased from 66,473,682 to 79,980,635 kWh, and the maximum supply demanded from 27,326 to 31,194 kW. The average price obtained per kWh fell from 0.912d. to 0.838d. The work in connection with the change-over to a.c. has been steadily proceeded with, the maximum demand for d.c. supplies having been reduced from 1,670 to 876 kW during the last three years.

Sheffield.—YEAR'S WORKING.—We have received from Mr. H. E. Yerbury, acting general manager and engineer, a copy of his report together with a statement of accounts for the twelve months ended March 31st last. The total income showed a decrease from £931,472 to £850,191, as compared with the preceding year, but the working expenses rose from £380,607 to £385,112. The gross profit (£465,079) was therefore lower, the previous year's figure being £550,865. Income from other sources made a total of £482,289 available. Income tax, interest on loans, and contributions to sinking fund absorbed £367,816, leaving a net surplus of £114,473 as compared with £247,432 in 1927-28. The capital expenditure during the year amounted to £364,777, of which £328,525 was spent on mains, services, and sub-station equipment. The total now spent on the undertaking is £5,378,714. The electrical energy sold increased from 198,228,994 to 208,843,221 kWh, and the maximum supply demanded from 88,724 to 92,196 kVA. The average price obtained per kWh fell from 1.113d. to 0.964d. The number of consumers increased by 9,826, the total now connected being 57,347. During the year 150 miles of additional feeder and distribution mains were laid, bringing the total mileage up to 1,354, and the total connections increased by 20,941 kW to 290,196 kW.

Sleaford.—CABLE EXTENSION.—The Urban District Council Electricity Committee has decided to extend cables at a cost of £1,557.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Mersey Power Co., Ltd., to supply electricity in part of the parish of Weston, in the rural district of Runcorn; the Power Development Co., Ltd., for the supply by the West Hampshire Electricity Co., Ltd., of electricity in part of the rural districts of Salisbury and Fordingbridge; W. H. Burton, E. Burton and W. Burton to supply electricity in the rural districts of Aysgarth and Reeth; and the Hawes Electric Lighting Co., Ltd., to supply electricity in part of the rural district of Aysgarth.

Stone (Staffs).—ELECTRICITY SUPPLY.—The Urban District Council has decided to give a supply of electricity to Tittensor at an estimated cost of £800, subject to the applicants giving the required guarantee for three years of 20 per cent. of the capital cost.

United States.—POWER STATION CONSTRUCTION.—According to *Power*, rapid progress is being made on three engineering projects for utility companies in the Standard Gas & Electric Co.'s system. The largest of the three is the 60,000-kW plant of the Duquesne Light Co. on Brunot Island, Pittsburgh, Pa. The building now under construction will be large enough to house two 60-000 kW generators and six boilers, although only one generator and three boilers are being installed initially. The section of the intake tunnel between the new screen house and the power station is now complete, and work on the screen house well under way. The new 15,000-kW station of the Oklahoma Gas & Electric Co., of which Enid, Okla., is the operating headquarters, is scheduled for operation on February 1st, 1930. A steam turbine will be used, and the most modern generating equipment is to be installed, including superheaters, pre-heaters, and evaporators to purify feed water. The 10,000-kW addition to the Mountain States Power co.'s Coos Bay station at North Bend, Ore., is scheduled for completion by July 1st, 1930. Of the two boilers that will be erected to supply steam for the turbine, one is now being built. Erection of the superheater and the structural steel work has also been started.

Winchester.—LOAN.—The City Council has applied for sanction to a loan of £3,780 for a new feeder cable from the power station to the Guildhall.

Witham.—PUBLIC LIGHTING.—The Urban District Council has accepted the offer of the East Anglian Electric Supply Co., Ltd., for public lighting at £7 15s. per 300-W lamp, lighted from sunset until 11 p.m.

York.—LOAN SANCTIONED.—The Corporation has obtained sanction to the borrowing of £1,460 for rectifying plant for the Groves sub-station.

Tramway and Railway Notes.

Cardiff.—EXTENSION OF TIME.—The Ministry of Transport has extended the period limited for the completion of the tramway authorised by the Cardiff Corporation Tramways Order, 1927, from July, 29th, 1929, to July 29th, 1930.

Costa Rica.—RAILWAY ELECTRIFICATION.—Work is well advanced on the electrification of the Pacific railway, which is owned and operated by the Government. The line is about 86 miles in length, and electric trains are expected to be running over it early next year.

Doncaster.—RAILLESS CARS.—At a meeting of the Town Council, held on August 7th, the Tramways Committee recommended that the railless-car system should be substituted on the Beckett Road, Hexthorpe, Avenue Road, Bentley, Racecourse, and Hyde Park tramway routes, on which there is a debt outstanding of £37,468. The Committee put forward a proposal that £5,000 should be taken from the revenue account and also a sum of £5,680 from the reserve fund towards extinguishing this debt, the balance to be paid from the Corporation rates. The chairman of the Committee said that it was hoped that the railless-car system would render unnecessary any additional rates, but provision would have to be made in case the receipts were inadequate. The recommendations of the Committee were adopted.

London.—NEW 'BUSES.—The London General Omnibus Company has introduced a new pneumatic-tired six-wheeled omnibus, known as the L.T.1 type. It is the thirty-seventh type which has been built and operated by the L.G.O.C. during the last twenty years. The new 'bus resembles a modern touring coach, and has upholstered seats for 54 passengers (upper deck 30, lower deck 24). No lighting fittings are visible on either deck, as sections of the ceiling have been fitted with translucent panels which form part of the curves of the roof, so that the light is diffused throughout the 'bus and is efficiently strong to allow of newspapers being read in comfort. The engine is of the 90-h.p. 6-cylinder "Renown" type, built by the Associated Equipment Company, of Southall, designed for use on outlying routes where higher speeds are possible. The dynamo is positively driven by timing chains, no belts being used; all accessories, such as dynamo, magneto, and sparking plugs are accessibly mounted on the nearside of the engine, and an electric starter is fitted as standard equipment. The generator consists of a 12-volt C.A.V. directly-driven dynamo of the constant-voltage type. It has a continuous rating of 45 amperes, and cuts in at a low engine speed. The switchboard is fitted with a cut-out and regulator, and five lamps are supplied with the

chassis. Powerful head lamps, a lead accumulator, and an electric horn are provided.

Manchester.—Tramway Extension.—The Corporation Tramways Committee has decided to proceed with the construction of the tramway along Thompson Street.

Tramway Abandoned.—The City Council decided on August 7th to apply for sanction to a loan of £110,000 for the purpose of substituting double-deck 'buses for single-deck tramcars on one of the principal routes.

Newport (Mon.).—Year's Working.—A total revenue of £89,332, as compared with £102,303 for the preceding year, is shown in the accounts of the Corporation tramway undertaking (general manager, Mr. N. J. Young; tramway engineer, Mr. A. Nichols Moore) for the twelve months ended March 31st last. There was a decrease in working expenses from £78,750 to £67,180, leaving a gross profit of £22,152, as against £23,553 for 1927-28. To the gross profit was added income from other sources, making a total of £29,633 available. Interest on loans, contributions to sinking fund, income tax and permanent way renewals amounted to £31,216, leaving a net deficiency of £1,583, as compared with £2,803 the previous year. The net capital expenditure during the year was £3,530. The number of passengers carried decreased from 16,028,051 to 14,036,395, and the car miles run from 1,315,536 to 1,233,856. The average revenue per car mile fell from 18.663d. to 17.376d.

Telegraph and Telephone Notes.

The Telephone Service.—London.—The daily telephone traffic in the London area averages about 2,375,000 calls. Of the 135 exchanges in the area, in 15 only is automatic switching employed as yet.

"Big Five" Nations.—Great Britain, according to the latest statistics published by the *Telegraph and Telephone Journal*, occupies third position among the largest telephone-using nations. The figures are as follows:—United States, 19,341,000; Germany, 2,950,000; Great Britain, 1,759,680; Canada, 1,341,219; France, 965,519.

Exchange Fire.—A fire, spreading from adjoining property, damaged the telephone exchange premises serving Sidcup and Chislehurst last week, with the result that the exchange was put out of action. As a new switchboard will have to be installed, a few days must necessarily elapse before communication is fully restored. Meanwhile a number of circuits of general utility (such as fire, police, hospital, and call offices) have been connected temporarily with adjoining exchanges.

Transoceanic Telephony.—Hispano-Argentinian Service.—A telephone service between Spain and Argentina was inaugurated on August 6th.—*Reuter's* (Madrid).

Atlantic Cable.—For some time past negotiations have been in progress between the British Post Office and the American Telephone & Telegraph Co., which proposes to lay a submarine cable across the Atlantic at a cost of about £3,000,000, having channels for both telegraphy and telephony. Mr. W. T. Leech, Director of Telegraphs and Telephones, is reported to have told a *Daily News* representative that at present the negotiations were dormant because lengths of cable were being manufactured to the specification of the American company for test. When ready, short cable lengths would be sunk some 3½ miles out in the Atlantic and certain electrical tests would be carried out.

China.—Automatic Telephony.—The Chinese Telephone Co. has decided to convert the telephone exchange system in Shanghai from manual to automatic operation and a contract has been placed in the United States.

Algeria.—Telephony.—La Société des Lignes Telegraphiques at Telephoniques Nord-Africaines, of Algiers, has secured a contract for the construction and laying of an underground telephone and telegraph cable between Oran, Algiers, and Constantine.

Radio Notes.

Austria.—Educational.—Plans are in hand to provide twenty-five agricultural schools in Upper Austria with wireless loud-speakers by means of which students will be able to listen to a weekly talk on agricultural subjects broadcast from the radio station at Linz.

Germany.—Superheterodyne Principle.—The German Patent Office has recognised the priority claims of Mr. Lucien Levy, the French radio manufacturer, for the discovery of the superheterodyne principle, says the *Wireless World*, which states that three other parties claimed priority, *viz.*, the Telefunken Co., of Berlin; Etablissements Ducretet, Paris; and the Société des Marques et Brevets, Paris. The German Patent Office holds that "the idea of the amplification of intermediate frequency, after the change of frequency has been effected, is clearly contained in the French patent 493,660" (Mr. Levy's) of August 4th, 1917, and rejects the argument that the principle was not patentable at the time the patent was taken out. The number of the German patent is 50,860, dated July 2nd, 1920.

Sweden.—Stations.—Wireless Service, Limited, began working in 1925 under the authority of the Royal Telegraph Board, which takes the greater part of the licence fee of just under 10s. The board maintains six main stations and one high-power station (Motala) of 30 kilowatts; a new station of 50 kilowatts is being built in Stockholm, and the board, in co-operation with local authorities, has some twenty-five small relay stations. With a population of more than 6,000,000, Sweden has about 400,000 listeners.

Norway.—Licences.—Experimental broadcasting was started in December, 1924, and the Broadcasting Company, Limited, was formed in February, 1925. The present Oslo station was opened in April, 1925, for regular service; since then eight other stations have been brought into use, and a 50-kilowatt station is nearing completion near Oslo, which will be, at least for a time, the most powerful station in Europe. A year's licence costs 22s. 6d., and at the end of May last, according to *World-Radio*, there were 65,985 licensed listeners.

France.—Radio on Trains.—The French State Railways have decided to install wireless apparatus on certain trains. From October onwards passengers between Le Havre and Paris will be able to relieve the monotony of the journey by listening, says the *Morning Post*, which explains that a wireless engineer in a special cabin will supervise the reception of wireless programmes, which headphones will enable each passenger to hear.

Wireless Offences. — Prosecutions.—The prosecutions undertaken in the London, Metropolitan, area during the month of July for wireless offences numbered 23, and fines totalling over £30 were inflicted.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—September 30th. State Electricity Commission. Three 3,000-kVA transformers and spares. (B.X. 5523.)*

October 7th. 11,000-V three-core cable. (B.X. 5539.)*

October 1st. Posts and Telegraphs Department. Switchboard cords. (B.X. 5515.)*

September 17th. Petrol electric sets. (B.X. 5537.)*

October 15th. Switchboard instruments, test plugs and sleeves. (B.X. 5541.)*

Perth (W.A.).—November 29th. Western Australian Government. Complete boiler-house equipment, one 12,500-kW turbo-generator and condensing plant. (See this issue.)

Belgium.—Brussels.—August 26th. Post and Telegraph Authorities. Supply and laying of new telephone cables between Ghent and Antwerp, Liége and Combain-au-Pont, Verviers and Francorchamps, and Charleroi and Liége. Particulars (Cahier des Charges Special) for 6¼ fr.

August 21st. Supply of 250 tons of annealed bronze wire in six lots and one lot of 6 tons of annealed copper wire. Particulars (Cahier des Charges Special No. 3,424) for 2¼ fr.

Bury.—August 31st. Ins allation of electric refrigerator at Florence Nightingale Hospital and the Aitken Sanatorium, Holcombe. Tenders to Mr. F. Wild, clerk to the Bury and District Joint Hospital Board, 2, Cross Street, Bury.

Canada.—Canadian National Railways. Power-driven shovels with caterpillar traction. (A.X. 8230.)*

Dundee.—August 20th. Harbour Trust. One electric passenger lift. Specifications, &c., from Mr. J. H. Thompson, general manager and engineer, Harbour Chambers.

Doncaster.—August 30th. Education Committee. Installation of electric lighting at Highfields Council school. Specifications from Mr. A. J. Dempster, divisional clerk, Education Offices, Christchurch Road, Doncaster.

Egypt.—CAIRO.—September 23rd. Ministry of Interior. Electric lighting installation and distribution system for the town of Kafr-el-Cheikh (Gharbieh Province). (B.X. 5502.)*
October 1st. Tanzim Department. Ministry of Public Works. Electric lamp standards. (A.X. 8251.)*

Gloucester.—August 26th. Committee of Visitors. Electric wiring installation at the Wooton and Coney Hill Mental Hospital. (July 12th.)

Haddington.—September 7th. East Lothian Education Authority. Electrical installation at the new public schools at Aberlady and Longoudry. Schedules, &c., from Morham and Brotchie, surveyors, 29, Hanover Street, Edinburgh.

Harrogate.—September 7th. Electricity Department. Supply, delivery and erection of overhead 11,000-V e.h.p. and 346/200-V l.p. lines. (See this issue.)

India.—SIMLA.—August 28th. Indian Stores Department. One 30-kW 2-wire d.c. generating set. (B.X. 5522.)*

London. — CENTRAL ELECTRICITY BOARD.—August 31st. Supply, delivery, and erection of 132,000-V outdoor switchgear for the Mid-East England Electricity Scheme, 1929. (July 19th.)
September 11th. Supply, delivery, and erection of 132-kV overhead transmission lines (approach to Clarence Dock, Liverpool). (August 2nd.)
August 24th. Supply, delivery, and erection of metering equipment for certain stations in the area of the South-East England Electricity Scheme, 1927. (August 2nd.)
LONDON COUNTY COUNCIL.—September 9th. Supply and erection of e.h.p. switchgear, &c., for tramway sub-stations. (August 9th.)
HACKNEY.—October 9th. Electricity Department. Three 125,000 normal 150,000 maximum lb.-per-hr. water-tube boilers, chain-grate stokers, &c. One 30,000-kW turbo-alternator, with exciter, &c. Fourteen 6,600-V, 3-phase, metal-clad oil circuit-breaker equipments. (July 26th.).
POPLAR.—August 28th. Board of Guardians. E.h.p. switchgear, 75-kW mercury-arc rectifier, and l.p. d.c. switchboard at the Institution. (August 2nd.)
WOOLWICH.—September 4th. Union Guardians. Refrigerating plant at the Plumstead and District Hospital. (See this issue.)

Manchester.—August 30th. Electricity Committee. One 130,000-lb. water-tube boiler, superheater, &c. (August 2nd.)

New Mills.—September 9th. Urban District Council. Electrical equipment, comprising e.h.p. and l.p. switchgear, cables, feeder pillars, &c. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. September 10th. Two-conductor cords. (B.X. 5462.)*
October 1st. Telephone bolts, brackets, &c. (B.X. 5560.)*
October 15th. Resistances. (B.X. 5551.)* Coils. (B.X. 5552.)*
October 16th. Supply and delivery of automatic wall and table telephones. (B.X. 5509.)*
Corporation. September 30th. Electric motors, starters and switchgear for the Milk Department. (B.X. 5508.)*
INVERCARGILL.—September 23rd. Corporation. Supply and delivery of an 11,000-V, 3-phase, 50-cycle switchboard. (B.X. 5507.)*
MARBOROUGH.—September 28th. Electric Power Board. 600-b.h.p. Diesel-driven generating plant and switchgear. (B.X. 5556.)*

Plymouth.—August 30th. Corporation. Supply, as required by the various departments, of electrician's ironmongery, &c. Tenders on official forms to Mr. R. J. Fittall, town clerk, Municipal Offices.

Portsmouth.—Electricity Department. Supply, delivery, and installation of armour-clad e.h.p. switchgear at the generating station. (See this issue.)

Scarborough.—September 7th. Electricity Department. Supply and erection of e.h.p. and l.p. overhead lines, and supply of e.h.p. and l.p. paper-insulated cable. (See this issue.)

South Africa.—PRETORIA.—Posts and Telegraphs Department. August 22nd. Telephone apparatus, including extension magneto bells, bell sets, terminal blocks, condensers, magneto generators, carbon protectors, magneto switch extensions, private branch exchange, central battery switchboards, tumbler switches, and wall and table telephones. (B.X. 5415.)*
Town Council. September 2nd. Supply of columns, fittings, lanterns, &c., required for street lighting, and one master clock for frequency regulation at the power station. (A.X. 8332.)*
BULAWAYO.—September 13th. Municipal Council. H.p. overhead transmission lines with accessories and stepdown transformers, pumps and motors with starters, pipework and float control gear. (A.X. 8181.)*
DURBAN.—September 27th. Corporation. Supply and delivery of three-phase ironclad compound-filled switch panels. (B.X. 5505.)*
JOHANNESBURG.—August 22nd. Railways and Harbours. Supply of telegraph material. (A.X. 8335.)*
August 29th. Supply and delivery of 3,000 lamp fittings. (B.X. 5534.)*
August 22nd. City Council. Automatic traffic signals. (B.X. 5547.)*
August 29th. Insulated copper wire, "weatherproof." (B.X. 5565.)*
CAPE TOWN.—September 4th. Town Council. Overhead line material. (A.X. 8334.)*
MAFEKING.—September 9th. Municipal Council. Steam-raising plant, engine alternators, chimney, and switchgear. (A.X. 8352.)*

Warrington.—September 2nd. Electricity Department. Twelve months' supply of e.h.p. and l.p. paper- and lead-covered cables, earthenware conduits, cable protector slabs and tiles, and hard burned red tiles. (See this issue.)

West Ham.—September 16th. Education Committee. Installation of electric light and water heating apparatus at Plaistow secondary school now in course of erection. (See this issue.)

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Aldershot.—Town Council. Accepted :—
Distributing, feeder, and pilot cable (£2,429).—Callender's Cable & Construction Co., Ltd.

Australia.—SYDNEY.—**Municipal Council.**
145,900 yd. 33,000-V cable and pilot cable and 595 sets jointing materials (£266,083).—Siemens (Australia), Pty., Ltd.
6,700 yd. ditto and 26 sets ditto (£12,124).—Standard Telephones and Cables (Australia), Ltd.
6,400 yd. ditto and 25 ditto (£12,564).—Enfield Cable Works (Australia), Ltd.
3,000 yd. cable and necessary jointing material (£5,630).—Metropolitan-Vickers Electrical Co., Ltd.

Colchester.—Electricity Committee. Recommended:—
200-kVA transformer (£129).—Metropolitan-Vickers Electrical Co., Ltd.
Two 1,500-kVA step-up transformers and switchgear for Hythe station (£3,200).—Electric Construction Co., Ltd.
Two switch cubicles (£290).—Electric Construction Co., Ltd.
Three transformer kiosks (£1,278).—Ferguson, Pailin, Ltd.
Education Committee. Recommended :—
Electrical wiring at Lexden school (£198).—E. Baillie and Co.

Coventry.—Board of Guardians. Accepted :—
Installation of an X-ray equipment at the hospital (£919).—Newton & Wright, Ltd.

Eastbourne.—Electricity Committee :—
Switchgear and transformers in connection with bulk supply :—

Switchgear & Cowans, Ltd.	£30,579
A. Reyrolle & Co., Ltd.	30,383
British Thomson-Houston Co., Ltd.	30,259
Metropolitan-Vickers Electric Co., Ltd. ...	30,056
Ferguson Pailin, Ltd.	28,793
General Electric Co., Ltd. (recommended)	28,678
English Electric Co., Ltd.	28,664

Glasgow.—Watch Committee. Accepted :—
Electric lighting at Kinning Park Hall.—Malcolm and Allan.
Tramways Committee. Accepted :—
Nuts.—P. & W. M'Lellan, Ltd.
Section pillar castings.—D. King & Sons, Ltd.
Electricity Committee. Recommended :—
Six 400-kVA transformers (£169 each).—Bruce Peebles and Co., Ltd.
Municipal Buildings Committee. Accepted :—
Supply of electric lamps to the City Chambers.—J. T. Cartwright & Sons.

Hull.—Electricity Committee. Accepted :—
Lamps and fittings.—General Electric Co., Ltd.
Joint shells.—A. & W. Bury.
Fuse boxes.—Sykes & Dyson; J. H. Tucker & Co., Ltd.; J. A. Crabtree & Co., Ltd.; Siemens Bros. & Co., Ltd.; W. Lucy & Co., Ltd.
Meter boards.—T. Beadle & Co., Ltd.
T.c. fuse wire and strip.—Enfield Cable Works, Ltd.
Lead wire.—Siemens Bros. & Co., Ltd.
Conduit tubing.—Simplex Conduits, Ltd.
Conduit fittings.—B. Danby & Co., Ltd.
V.i.r. and c.t.s. cables.—Edison & Swan Electric Co., Ltd.
Steam pipe and fittings.—H. Halnshaw, Ltd.

Leven (Fife).—Town Council. Accepted:—
Installation of electric light in the new municipal house (£177).—J. Suttie.

Manchester.—Housing Committee. Accepted:—
Electrical installation in houses on the Moston estate.—Hall & Stinson.
Electricity Committee. Accepted:—
Rebuilding chimneys.—Babcock & Wilcox, Ltd.
Static transformers.—Fuller Electrical & Manufacturing Co., Ltd.; C. A. Parsons & Co., Ltd.; Metropolitan-Vickers Electrical Co., Ltd.
Tramways Committee. Accepted:—
Special track work.—Edgar Allen & Co., Ltd., and Titan Trackwork Co., Ltd.
Tramcar trucks and brakes.—Brush Electrical Engineering Co., Ltd.
Steel underframes for tramcar bodies.—Hurst, Nelson and Co., Ltd.
Water Committee. Accepted:—
Lighting cottages at Thirlmere waterworks.—Brown and Co. (Electrical Engineers), Ltd.

Oldham.—Education Committee. Accepted:—
Electric lighting installation at Wellington Street School.—Caton & Sons.
Electricity Committee. Accepted:—
Cable.—Union Cable Co., Ltd.

Reigate.—Town Council. Accepted:—
Refuse destructor, including electrical plant, &c. (£11,526).—Manlove, Alliott & Co., Ltd.

Salford.—Electricity Committee. Accepted:—
Six 125-kVA sub-station-type transformers (£486), eight 125-kVA pit-type ditto (£696), four underground street pits, with covers (£160).—Metropolitan-Vickers Electrical Co., Ltd.

Sutton and Cheam.—Urban District Council. Accepted:—
Installation of a fire alarm system (£1,076).—Standard Telephones & Cables, Ltd.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope. We should be glad to learn the following:—

Osborne megger testing set and combined d.c. voltmeter scale.

Notes.

"Model Engineer" Exhibition.

The eleventh engineering exhibition held annually under the auspices of the *Model Engineer* opens on Saturday, September 7th, in the Royal Horticultural Hall, Vincent's Square, Westminster, lasting for one week.

132-kV Cables in America.

After continuous operation without a break in service since August, 1927, the 12-mile, 132,000-volt underground cable "having a capacity of approximately 125,000 horse-power" that connects the Hell Gate generating station of the United Electric Light and Power Company to the Dunwoodie distributing station of the Yonkers Electric Light and Power Company is being duplicated by the laying of a second cable line of the same voltage; installation started recently, and the work is expected to be completed in September. The new cable, which is to give the system of companies headed by Mr. Matthew S. Sloan added facilities for serving the Westchester area, contains a number of refinements resulting from operating experience with the older cable. The latter was shipped from the factory with the oil drained off, and required refilling after installation, which was a lengthy process requiring great care. The new cable lengths are to be shipped from the Schenectady plant of the General Electric Company with the core filled with oil supplied by temporary reservoirs mounted inside the cable reels. The jointing is to be done under oil pressure with the temporary reservoirs connected to the opposite ends, and is expected to be accomplished with very little loss of oil. In the case of the first cable the permanent oil reservoirs were placed about one mile apart, and the maximum oil pressure on the cable was approximately 30 lb. The new cable's reservoirs are to be placed about three to the mile, and the maximum pressure will be approximately 16 lb., so the result of the decreased pressure will be a reduction of the amount of sheathing necessary. The first cable has a double sheating; the inner layer of lead is reinforced by a spiral wrap of copper tape to impart the strength necessary to stand the oil pressure, and over this is a second layer of lead to protect the copper tape from abrasion and corrosion. With the oil pressure reduced to half the copper binder and outer lead sheath will not be necessary.

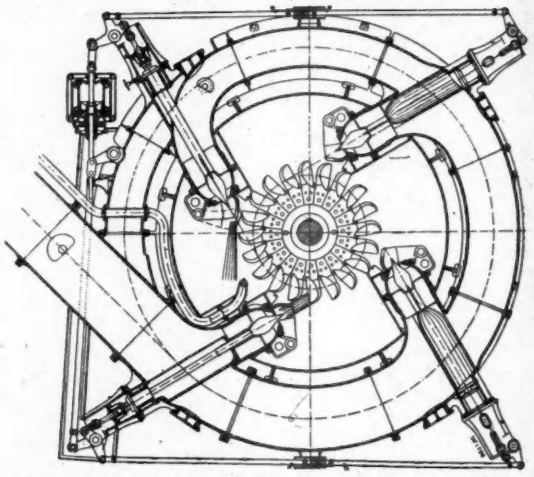
Faraday Electromagnetic Centenary.

The arrangements initiated by the Royal Institution for the celebration of the Centenary of Faraday's discovery of electromagnetic induction have already been announced.* At the representative meeting held at the House of the Institution on February 5th, 1929, the formation of two committees was agreed to, and these committees are now at work. The first, consisting of representatives of the Royal Society, the British Association, and other scientific societies, as well as the Royal Institution, is concerned with the purely scientific aspects of Faraday's work in relation to the proposed celebrations; the second committee, which has been called together by the Institution of Electrical Engineers, consists of representatives of the principal organisations of those industries which have risen in the past hundred years upon the scientific foundation of Faraday's discoveries, and is dealing with the industrial aspects of the celebrations.

The two committees are working in close co-operation; the preliminary discussions which have taken place indicate that the significance of the Centenary is very widely appreciated, and that the celebrations are likely to arouse world-wide interest and support. The dates have now been fixed, and the proceedings will commence in London on Monday, September 21st, 1931. Further, an intimation has been received from the British Association that their Centenary meeting will be held in London during the week commencing September 23rd, 1931. These two Centenaries, with important electrical conferences and other events which are to take place about the same time, will thus conjoin to make the year 1931 a memorable one in this and every country where the genius of Faraday has borne fruit.

A Chilean Hydro-Electric Plant.

A hydro-electric power station has recently been completed at Maipo, Chile, by the Whitehall Securities Corporation, Ltd. The plant comprises an Escher-Wyss Pelton-type four-nozzle single-wheel turbine, with a superimposed vertical-shaft generator. The set, which runs at 250 r.p.m., works under a head of 675 ft., and develops 18,600 h.p. A feature of the set is that



Plan of 18,600-h.p. Hydraulic Set, showing Water-intake Base.

the ring-shaped water-intake pipe line serves as a base for supporting the generator (see accompanying illustration). In addition to enabling the plant to be located on a single floor, this arrangement enables the number of bearings to be reduced to two. The stator is supported by means of a strong cast-iron yoke, the openings in which afford access to the lower guide bearing, the governor drive and the regulating mechanism of the jet deflectors. The four needles of the water nozzles are operated by a servo-motor arranged on the same level and controlled by oil under pressure.

An Electrical Whaling Harpoon.

A joint-stock company with a capital of 5,000,000 kroner (approximately £275,000) is now being formed to exploit an invention for killing whales by electricity. As soon as the special harpoon strikes into the blubber, the whale is seized with tetanus and dies, while the body remains floating.—*Reuter* (Oslo).

The E.T.B.I. Competition.

The secretary of the Electrical Trades Benevolent Institution has sent us a further list of articles which have been presented by, amongst others, the British Thomson-Houston Co., Ltd.; L. G. Hawkins & Co., Ltd.; S. G. Leach & Co., Ltd.; Venner Time Switches, Ltd.; and Messrs. Young & Wildsmith, as prizes to be won in the Institution's Cable Competition. The competition has only been running for one month, but barely 100 books of tickets are left for disposal. Therefore anyone

* Electrical Review, February 15th, 1929, p. 309.

wishing to obtain tickets should apply immediately to the secretary, E.T.B.I., 9, Southampton Street, Holborn, London, W.C.1, as further tickets will not be printed after the few remaining ones have been disposed of.

Power Engineers Visit Stourport.

On a recent Saturday afternoon a party of about 120 members of the Midland Section of the Electrical Power Engineers' Association assembled at the head office, Mucklows Hill, of the Shropshire, Worcestershire and Staffordshire Electric Power Company, and journeyed thence in over thirty private cars, *via* Romsley, Catshill, Bromsgrove, Droitwich and Hartlebury, to the Stourport power house of the Company, the route being selected in order that the party should see some examples of rural development in the form of overhead high-pressure transmission and low-pressure distribution lines. On arrival at the power house the party assembled on the steps of the

E.P.E.A. Group at Stourport.

main entrance for a photograph to be taken, which is reproduced herewith, following which tea was served under an awning erected on the main switch-house roof. The chairman of the Section (Mr. D. J. Duffy) thanked the company for its welcome and courtesy, and for the trouble it had taken to make the visit interesting, which remarks were suitably responded to by Mr. E. E. Hamar, representing the chief engineer and manager of the Company (Mr. J. T. H. Legge) who was unable to attend. Mr. T. E. Boothby, chief engineer of the power stations of the Company, stated how pleased he and also the resident engineer (Mr. H. North) were to have such a large number of engineers present and, although the Shropshire Company's staff had given up their Saturday afternoon, it was indeed a privilege and pleasure to all concerned. The party was then divided up and a tour of inspection commenced, concluding about 7.0 p.m., when the members left for their respective destinations, even as far away as Leicester and Nottingham.

Fatalities.

Bertram Augustus Stanton, aged 34, an electrician employed by Messrs. M. B. Wild & Co., engineers, of Birmingham, received a fatal electric shock whilst at work on Friday, August 9th. He was at work on a crane when he slipped and fell across a live wire.

Whilst employed on repair work in connection with an electric light failure in a shop in Conduit Street, W., William Goodall, employed by the London Electrical Co., recently came into contact with a main and received a fatal shock at 2,500 V.

First 220-kV Transmission Line in Europe.

The Cologne-Rheinau (Mannheim) section of the 220-kV overhead transmission line built in 1926 by the Rheinisch-Westfalische Elektricitats-Werk, of Essen, Germany, has up to the present been operated at 110 kV. Work is now in progress to extend the line as far as the Vorarlberg, and at the same time to operate it at 220 kV. The line is to be completed in 1930. It is believed that it will be the first 220-kV transmission line to be worked in Europe. The contract for the complete equipment for seven transformer stations for 220/110 kV has been placed with the Siemens-Schuckert Co., of Berlin. The stations are to be of the outdoor type, and will comprise: 220-kV equipment—14 three-phase oil-cooled transformers for 60,000 kVA each, 220/110 kV, 36 three-tank oil switches with surge protection, and 104 triple-pole disconnecting links; 110-kV equipment—26 three-tank oil switches with surge protection, 125 triple-pole disconnecting links, 105 cascade voltage transformers and 75 current transformers. The 60,000-kVA transformers are arranged for compressed-air circulation of the cooling oil. The weight of each transformer, without cooling apparatus, is about 180 tons. For rail transport a special 36-wheel truck with four bogies will be employed for each transformer, the transformer being held suspended in the truck by means of a special transport cage. The truck and transformer will have a length of 128 ft. Since the neutral point of the 220-kV line, in contrast with American and Japanese practice, will not be earthed, the insulation must be provided for the full 220 kV.

Ultra-violet-ray Meter.

Dr. H. C. Rentschler, the newly-elected president of the New York Electrical Society, in an address delivered before that body recently, stated that the danger that lurked in concentrated treatment with ultra-violet rays, if given in excessive doses, was rapidly becoming recognised by the general public as well as by professional men. Too much powerful radiation, while not felt at the time, could create sharp nervous reactions, and even burns of such intensity as to become serious; other indirect effects were also attributed to such rays. The greatest difficulty with present methods of dosage was the unavoidable variation in intensity, which could not be registered by measurement apparatus now in use, and yet could actually cause an overdose (or for that matter a too small dose) to be administered. It was desirable to apply the most exact dose possible, especially in the case of treatment for rickets. Results could be better gauged and more effective treatment given if guesswork was eliminated. Dr. Rentschler outlined the various materials used in making photo-electric cells at present; the alkali metals, particularly caesium in certain forms, being more sensitive to the long waves of red and infra-red light; cerium for the blues and violets; and thorium for certain parts of the ultra-violet spectrum. The problem of constructing a cell sensitive only to the anti-rachitic radiations of the ultra-violet region was claimed to have been solved by Dr. Rentschler and his assistants by the use of uranium, one of the rarer elements which, when applied according to their methods, responded only to the curative radiations sought. To show the various regions of the ultra-violet spectrum and also to demonstrate the sensitivity of his new cell to the invisible radiations, Dr. Rentschler used a quartz-mercury arc and a quartz spectroscope; by focussing on a flourescent screen rather than a sheet of white paper, a wide band of ultra-violet radiation not seen against the paper was brought out on the screen. By subjecting the uranium cell to one region of the normally invisible radiation as shown by the fluorescent screen, the electric current produced in the cell was passed into a condenser, which stored the charge until a given potential had been reached. It was then made to discharge through a special form of argon glow tube (in the actual demonstration a neon tube was used, as its red glow was more visible), which gave a bluish flash as the discharge occurred. The number of flashes of the glow tube allowed a close calculation of the amount of ultra-violet rays being given off by any lamp, carbon arc, mercury-arc, or other type to be made. In order to simplify the arrangement, Dr. Rentschler explained, they had brought into use a modified glow tube with two anodes and one cathode, which, by breaking down the resistance of the main circuit as the condenser discharged through it, operated a counter, or ink pencil, against a piece of paper on a revolving drum moving at constant speed. The number of marks indicated the total quantity of ultra-violet light, while the frequency of them on the paper showed the average intensity of the radiation. Thus, any flickering of the light source would be allowed for, or reduced intensity, due to operation of a too-cool mercury arc, could be checked. Controlled dosage marked one of the most important steps forward in ultra-violet-ray therapy.

Heating Orchid Houses.

An interesting example of the practical application of electric heating comes from the North of England, where a keen amateur grower of orchids who uses large greenhouses for cultivating tropical plants has hitherto had to depend upon hot-water pipes connected to a coke-fired boiler for the maintenance of a uniform temperature and the required degree of humidity. During the winter months orchids die off quickly if they are subjected to a lower temperature than 60 deg. F., so that constant attention to the coke boiler was required to keep the heat of the orchid house at that figure. Firing late at night, again early in the morning, as well as several times during the day, proved tiresome, especially as in other houses containing semi-tropical plants a lower temperature was sufficient. The obvious remedy, therefore, was to install separate heating plant for the orchid house and make it independent of the remainder of the buildings. For that purpose the industrial heating department of the General Electric Co., Ltd., designed a special heavy water-proof type of tubular heater. A number of them were experimentally installed in the orchid house to a total length of 82 ft., with a loading of 16 kW, connected directly to the 3-phase network. To preserve the proper saturation of the atmosphere, the heaters themselves are constantly covered with water, which speaks well for their design, and accurate temperature control in the orchid house is effected by means of an adjustable air thermostat working in conjunction with a 3-pole 25-amp. "Witton" ironclad contactor. With the

advantage of a special tariff of ½d. per kWh the orchid grower is now congratulating himself on the general convenience and more economic advantages of electric tubular heaters, as compared with the old-fashioned system of heating they have superseded.

Garage Lighting.

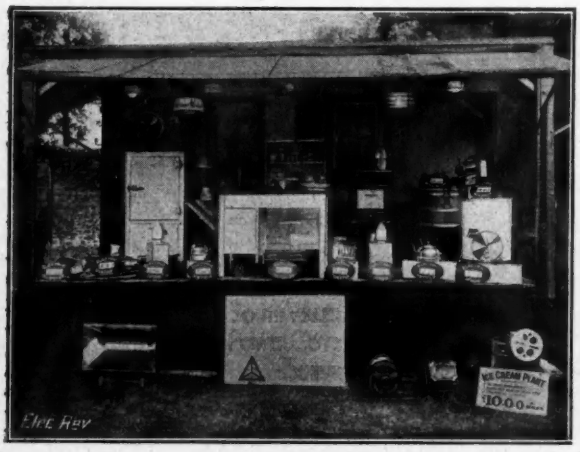
An important step in the progress of motor-coach operation has been made by the construction of a large station at Kennington Oval, expressly for the purpose of parking motor coaches whilst in London and providing all the necessary facilities for intending passengers. The station was designed for Southern Coastal Services, Ltd., by Mr. Edw. W. Wallis, L.R.I.B.A., and will be available for the use of motor-coach owners desiring parking facilities in the Metropolitan area. There is sufficient parking space for more than 250 coaches, in

Kennington Oval Motor-coach Garage at Night.

addition to a number of waiting rooms, buffet bars, booking offices, &c. As the station will remain open day and night an efficient lighting installation is essential, and Philips "N.R." type industrial reflectors with "Argenta" lamps have been decided upon, the work being carried out by Messrs. Pruden and Pope. The result has proved entirely satisfactory, the whole station being flooded with an evenly diffused light entirely free from glare. Fifty-four "N.R." reflectors with 300-watt "Argenta" lamps were installed in four rows, more closely spaced over the loading platforms than the remainder of the garage, resulting in 8-10 foot-candles over the platforms and 4-5 foot-candles elsewhere. The accompanying illustration depicts the lighting.

A Travelling Electrical Exhibit.

We have received from Mr. J. W. Beauchamp, M.I.E.E., engineer and manager, South Wales Electrical Power Distribution Co., the accompanying illustrations of a novel electrical exhibit which has just been brought out by the Company, which made its first appearance at the



Views of the South Wales Power Co.'s Travelling Exhibit at Cardiff.

Royal Welsh Agricultural Show at Cardiff on August 7th to 9th. It takes the form of a travelling electrical display, fitted in a caravan measuring inside about 15 ft. by 7 ft. by 7 ft. 3 in. high and running on solid rubber-tired wheels. The outfit can be trailed by a motor vehicle or drawn by horses. During the summer it is to visit various agricultural shows—the next being the notable Vale of Glamorgan Show at Cowbridge—and in the winter it will be taken round the numerous villages in the Power Company's electric lighting areas. All four sides of the caravan open, about two-thirds of each side opening upwards, being hinged at the top and forming a shelter roof. The lower portion of each side opens downwards, being hinged at the floor, and can either be allowed to fall right down, thus obscuring the wheels, or it can be supported in a horizontal position, so extending the floor of the caravan for exhibition purposes. The wiring for heating and power, by means of c.t.s. cable, is carried under a detachable false floor, in three sections, to flush-type 3-pin plug sockets sunk in the floor. The lighting wiring is in the roof, arranged by means of movable battens which can be shifted to any part. One batten holds 12 shop-window fittings, with three switches controlling different colours, and the centre batten holds a selection of fancy shades. Electrical apparatus of all kinds can be displayed and demonstrated in the open caravan, and at the Royal Welsh Show the South Wales Company made a very comprehensive exhibit, including an electrical refrigerator, ice-cream freezer, cooker, washing machine, vacuum sweepers, radiators, flat irons, toasters, coffee percolators, boiling rings, electrically heated "Hover" and other apparatus of interest to the farm, including also an electrical "Farmer's Boy," a portable machine enabling one motor to be readily moved from place to place and used for numerous operations, such as chaff cutting, root crushing, milk separating, butter making, &c., about the farm.

Appointments Vacant.

Mains assistant for Bedford Corporation. Cook-demonstrator for Manchester Corporation. Electrician for Richmond (Yorks.) Corporation. Deputy electrical engineer for Plymouth Corporation. Plumber cables jointers for Eccles Corporation. (See our advertisement pages to-day.)

B.S.S. for Ceiling-type Electric Fans.

The object of the new British Standard Specification (No. 367-1929), for the performance of ceiling-type electric fans, is to define certain features of propeller-type ceiling fans which relate to their performances, and to regulate the method of testing ceiling fans so that the results of the tests may be reasonably comparable. The type of fan covered by the specification is designed to rotate in free air, and to produce disturbance of the air in the room in which it is made to operate. It is obvious that to obtain a determination of the true air-movement in a room with a fan under working conditions would be extremely difficult and costly, since a large number of points would need to be examined, using instruments of high sensitivity and precision. In order to simplify the test, therefore, and make it suitable for commercial use, the specification provides a test which, whilst not strictly complying with the working conditions of the fan, is such that the effectiveness of the fan is in no way impaired. In the introduction to the specification it is explained that in preliminary tests in which the fan was suspended at the centre of a four-sided screen, it was found that the type of air-flow is characteristic and consists of a central stream of relatively high-speed air, covering an area only slightly larger than the sweep of the fan-blades, and a surrounding stream of air which is moving relatively slowly downwards. An analysis of the test-results has shown that practically all the variation takes place in this outer, or induced, stream and that the volume of air being removed directly by the fan-blades is practically constant. It therefore appeared that uniform results could only be obtained if the test were confined to the central air-stream. Consequently, for the purpose of this specification, the measurements are confined to this central stream. The specification suggests that a statement of the air-delivery per watt of input is a better indication of the service value of this type of fan than the determination of the overall mechanical efficiency, *i.e.*, the ratio of the actual power output to the power input. Copies of this specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The marriage took place at Crewe on August 5th of Mr. Conway Frederick John Morgan, of the research department of the Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, Manchester, and Miss Winifred Allen, second daughter of Mr. S. Allen, of Crewe.

Mr. C. R. Westlake, of the Bedford Corporation Electricity Department, has been selected from a short list of six for the appointment of engineer and manager of the Dumfriesshire County Council's electricity undertaking at Gretna and Dornock, and he will take up his new duties early in September.

Mr. A. E. Halliwell, late engineer in the Marine Department of Foster, Wheeler, Ltd., has taken up the duties of director and engineer with Phillips & Sons (Chiswick), Ltd., manufacturing electrical and mechanical engineers, of 42, Waterford Road, Walham Green, S.W.6.

Messrs. Metro-Vick Supplies announce that Mr. R. F. Huckstepp will in future represent them in the London area in place of Mr. Bonnor, who has left the company to take up other duties.

Major H. O. Wraith, M.I.E.E., M.I.Mech.E., has been appointed general manager of the Lighthouse Department of Chance Brothers & Co., Ltd., and of Austinlite, Ltd., the manufacturers of automatic generating plant, which firm has recently been acquired by Messrs. Chance Bros.

Mr. Richard Leslie Brown has been appointed deputy managing director of Messrs. Hopkinsons, Ltd.

Mr. A. G. C. Holroyde, A.M.I.E.E., who has been engaged during the past three years in the construction of the Guacaica hydro-electric plant and a number of passenger-carrying aerial ropeways on behalf of the Government of the Department of Caldas, Colombia, has been appointed chief engineer to the Empresas Unidas del Occidente of Cali, Columbia, and will be in charge of its hydro-electric plant, coffee mills and river steamers.

The marriage took place on August 1st, at the Parish Church, Hythe, Kent, of Miss Alice Marjorie Hilton, elder daughter of Capt. C. F. Hilton, A.M.I.E.E., of Hythe, and Rev. Thomas Walter Coombe, M.A.

Mr. George W. Lambert, of the staff of the English Electric Co., of Stafford, who was married on July 31st to Miss K. A. Tassall, has been presented by his colleagues with a canteen of cutlery.

Mr. Frederick Giles, of St. Albans, on completing 20 years' service with the North Metropolitan Electric Power Supply Co. at its works at St. Albans, has been presented with a wallet containing £20. The presentation was made on July 31st by the chairman of the company, Lord Ashfield.

Mr. A. B Catling, assistant mains superintendent, Corporation Electricity Department, Eccles, has been appointed to the position of mains superintendent at the electricity and Tramways Department, Barking.

At Blackpool Town Council, on August 7th, Councillor A. Renwick moved a resolution opposing an increase in the salary of Mr. Charles Furness, electrical engineer and tramway manager, from £1,250 to £1,600 per annum. The increase was approved by 27 votes to 19.

The first Lamme medal was presented before the Lamme Medal Committee of the American Institute of Electrical Engineers, to Mr. Allen Bertram Field at Swampscott, Mass, U.S.A. The speeches were broadcast. Mr. Field was awarded the medal for his "mathematical and experimental investigation of eddy current losses in large slot-wound conductors in electrical machinery." He is a consulting engineer to the Metropolitan-Vickers Electrical Co., Ltd., of Manchester. He attended the Finsbury Technical College, St. John's, Cambridge, and the University of London, but he did much valuable work in the United States when he went there in 1902, and from 1909, in which year he joined the Westinghouse interests in the States. In 1914 he was a consulting engineer and professor of mechanical engineering at Manchester University, and he joined the Metropolitan Vickers Co., of which he is now consulting engineer, in 1917. Not only did he work with Mr. Lamme in establishing principles in design that have been followed since 1909 throughout the Westinghouse organisation, but he was also identified with the installation of Niagara Falls generators, then the largest of their kind.

Eastbourne Corporation Electricity Committee has appointed Mr. D. W. A. Roberts as deputy borough electrical engineer at a salary of £559 per annum.

Obituary.—Mr. W. G. Cockrill.—We regret to announce the death of Mr. William Greenwood Cockrill, traffic superintendent of the Reading Corporation tramways. His illness was of short duration, and he died, after an operation, at the Royal Berkshire Hospital. Mr. Cockrill, who was 56 years of age, went to Reading from Blackpool when the electric tramway service was laid down in 1903.

Mr. J. C. Ward.—The death occurred last week of Mr. J. C. Ward, a director of Edgar Allen & Co., Ltd., with which company all his working life was spent either in London or Sheffield. He had been a leader in the industrial life of Sheffield and had travelled all over the world in pursuit of trade for Edgar Allen & Co.

Mr. J. Jeffery.—The death occurred on August 6th, at 10, Corona Road, Lee, S.E., of Mr. James Jeffery, M.I.E.E., of the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., of 106, Cannon Street, London, E.C.

Mr. J. S. Thomson.—The funeral of Mr. James Stuart Thomson, engineer and manager of the Fife Electric Power Co., Ltd., took place at Dunfermline Cemetery on August 1st. The mourners included the staff of the Fife Electric Power Co., Mr. Kenneth Sanderson, W.S., Edinburgh, a director of the company, Mr. G. A. Nicolson (secretary), Mr. Satelle, manager, Galashiels Electric Supply Co., Coun. Frain, Dundee, representing the Ediswan Co., Ltd., Mr. Lamond, Dundee, representing the Telephones Department of the Post Office, Mr. W. T. Dawson, manager, Wemyss Tramways Co., Ltd., Mr. H. B. McKinty, secretary, Fife Tramway, Light and Power Co., Ltd. Floral tributes were placed on the grave by the staffs of the Fife Electric Power Co. and of Messrs. Balfour, Beatty & Co., Ltd.

Wills.—The late Mr. W. J. S. Douglas, of Aylth, Perthshire, of the Western Telegraph Co., Ltd., left £7,383 personal estate.

The late Mr. Arthur Doyle, manager of the Morgan Crucible Co., Ltd., left £7,730 gross and £6,775 net.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Spalton Electrical Stores, Ltd.—Private company. Registered August 2nd. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical and general engineering plant and equipment, gramophones, wireless sets and accessories, &c. The directors are: A. H. Spalton, 14, Dalewood Drive, Sheffield, electrical factor; A. Lomas, Red Ridges, Rivelin, nr. Sheffield, director of limited company. Secretary: A. H. Spalton. Registered office: 18, Cadman Lane, Sheffield.

The United Dominions Trust (Electric), Ltd.—Registered as a "private" company on August 2nd, with a nominal capital of £250,000 in £1 shares. The objects are to carry on the business of banking in all its branches, and any business undertaken by bankers, capitalists, promoters, financiers, concessionaires, insurance brokers, merchants, underwriters, contractors, shipowners and mercantile, real estate, insurance, general and financial and investment agents, to grant special facilities to municipalities, municipal supply companies, private supply companies, electrical contractors, undertakers and manufacturers covering the sale, hire, hire-purchase, or any other method of disposing of all kinds of electrical equipment, &c. The subscribers (each with one share) are: G. E. Forecast, 98, Pixmore Avenue, Letchworth, law clerk; J. F

Seacombe, 1, Threadneedle Street, E.C.2, clerk. The first directors (to number not less than two nor more than seven) are to be appointed by the subscribers. Solicitors: Simmons and Simmons, 1, Threadneedle Street, E.C.2.

British Blue Spot Co., Ltd.—Private company. Registered August 10th. Capital, £100 in £1 shares. Objects:—To carry on the business of agents for the sale or distributors of all wireless, radio, gramophones, gramophone records, valves, instruments and accessories, electrical, magnetic, and radio-active instruments and switchboards, &c. The directors are:—G. W. Ball, "Parklands," Cowes, I.W. (director, F. A. Hughes & Co., Ltd.); J. H. Gibbon, "The Cottage," Springfield, Chelmsford, Essex (director of F. A. Hughes & Co., Ltd.). Secretary (*pro tem.*): H. C. Martin. Registered office: 204, Great Portland Street, W.1.

National Electrical Supplies Co., Ltd.—Private company. Registered August 12th. Capital, £3,000 in 2,000 8 per cent. cumulative preference shares of £1 each and 10,000 ordinary shares of 2s. each. Objects:—To acquire the goodwill of the National Electrical Supplies Co. and to carry on the business of electrical engineers and contractors, dealers in, and agents for, all kinds of electrical supplies, apparatus and supplies for lighting, heating, power, wireless and other purposes, &c. The directors are:—F. W. Evans (permanent and managing director), 34, Norfolk Road, Thornton Heath; G. W. Haddock, 9, High Street, Burnham-on-Crouch, Essex (both directors, Wood & Carling, Ltd., and Summit Electrical Co., Ltd.). Registered office: 15 and 16, Fisher Street, W.C.1.

Green & Jackson, Ltd.—Private company. Registered August 10th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electrical and mechanical engineers, &c. The subscribers (each with one share) are:—R. C. C. Green, "Arequipa," Broad Oaks Road, Solihull, electrical and mechanical engineer; Mrs. E. A. F. Green, "Arequipa," Broad Oaks Road, Solihull. The first directors are not named. Registered office: 12, Cherry Street, Birmingham.

Walker Brothers (Electrical Engineers), Ltd.—Private company. Registered August 10th. Capital, £10,000 in £1 shares. Objects:—To acquire the business of electrical engineers now carried on by Walker Bros. at Quality House, Temple Row, Birmingham. The subscribers (each with one share) are:—H. E. Walker, Quality House, Temple Row, Birmingham, electrical engineer; G. N. Walker, Quality House, Temple Row, Birmingham, electrical engineer. H. E. Walker is permanent director and chairman. Qualification: 2,000 ordinary shares. Solicitors: Howard Cant & Cheatle, 33, Newhall Street, Birmingham.

Rozalex, Ltd.—Private company. Registered August 6th. Capital, £100 in £1 shares. Objects:—To adopt an agreement with the Chloride Electrical Storage Co., Ltd., for the acquisition (*inter alia*) of the registered trade mark "Rozalex," and to carry on, develop, and turn to account so much of the business carried on by the said Chloride Electrical Storage Co., Ltd., as is comprised in the said agreement. The directors are:—H. V. Beebee, 17, Lambton Road, Worsley; C. E. Naylor, 44, Park Road, Pendleton, Manchester. No qualification required. Registered office: 26, Cooper Street, Manchester.

Texa Electrical Co., Ltd.—Private company. Registered August 6th. Capital, £1,000 in £1 shares. Objects:—To carry on the business of electricians, electrical and mechanical engineers, &c. The directors are:—G. Evans, "Shal-i-mar," 51, Old Park Avenue, Enfield (director of Tottenham Cinema and Entertainment Co., Ltd.); R. R. Thyssen, 6, Sussex Gardens, Bayswater, W.2; D. A. J. Woodford, 13, Gloucester Square, W. Secretary (*pro tem.*): G. Evans. Registered office: Chandos House, Buckingham Gate, S.W.

Price & Belsham, Ltd.—Private company. Registered August 6th. Capital, £3,350 in 2,250 preference and 1,100 ordinary shares of £1 each. Objects:—To acquire the business of an engineer as formerly carried on by J. T. Corbin as "Price & Belsham," at 52, Queen Victoria Street, E.C., and to carry on the business of engineers, founders, smiths, machinists, and manufacturers of engineering plant and machinery, &c. The directors are:—T. W. Corbin (managing director and chairman), "Chellaston," Caterham Valley, Surrey, engineer; S. J. Corbin, 104, North Side, Clapham Common, S.W.4, electrical engineer; A. F. Vickers, 82, Wakehurst Road, S.W.11, engineer. Registered office: 52, Queen Victoria Street, E.C.4.

Official Returns of Electrical Companies.

Baxter & Caunter, Ltd.—Satisfaction in full on July 18th, 1929, of two charges both dated July 8th, 1926, securing £3,000 and £2,000.

United Weldings & Electrical Co., Ltd.—Mr. W. H. Watson, of 36, Bulls Head Chambers, Manchester, ceased to act as Receiver or Manager on July 25th, 1929.

W. H. A. Robertson & Co., Ltd.—Capital, £36,000 in 600 ordinary and 3,000 preference shares of £10 each. Return dated July 4th, 1929. 600 ordinary and 2,180 preference shares taken up. £25,650 paid (being £10 per share on 1,750 preference and 600 ordinary and £5 per share on 430 preference shares). Mortgages and charges: £700.

John Lewis (Wireless), Ltd.—Capital, £100 in £1 shares. Return dated March 21st, 1929. All shares taken up. £100 paid. Mortgages and charges, nil.

Electrical Contracts & Maintenance Co. (1925), Ltd.—Capital, £3,000 in £1 shares. Return dated April 17th, 1929. 2,305 shares taken up. £2,305 paid. Mortgages and charges: At date of return £100 (since paid off).

Cambridge Electric Supply Co., Ltd.—Capital, £400,000 in £1 shares (increased from £260,000 in April, 1929). Return dated April 17th, 1929. 260,000 shares taken up, £235,000 paid (being £1 per share on 210,000 shares and 10s. per share on 50,000 shares). Mortgages and charges: £30,000.

Radio Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated September 28th, 1928 (filed May 3rd, 1929). 599 shares taken up. £599 considered as paid. Mortgages and charges, nil.

British Insulated Cables (S.A.), Ltd.—Capital, £2,000 in £1 shares. Return dated March 11th, 1929. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Northampton Electric Light & Power Co., Ltd.—Capital, £700,000 in 625,000 ordinary and 75,000 preference shares of £1 each. Return dated March 12th, 1929. 547,500 ordinary and 52,500 preference shares taken up. £599,729 5s. paid, leaving £270 15s. in arrears. Mortgages and charges: £286,000.

Singapore Traction Co., Ltd.—Capital, £400,000 in 200,000 preference, 199,999 ordinary and the management shares of £1 each. Return dated February 20th, 1929. 200,000 preference, 165,208 ordinary and the management shares taken up. £7 paid on 7 ordinary shares, £365,202 considered as paid on the remainder. Mortgages and charges: £195,875.

W. J. Henderson & Co., Ltd.—Capital, £3,000 in £1 shares. Return dated December 31st, 1928 (filed May 11th, 1929). All shares taken up. £743 paid, £2,255 considered as paid. £2 in arrears. Mortgages and charges, nil.

Burgess Hill & District Electric Supply Co., Ltd.—Capital, £10,000 in 4,000 "A" 7 per cent. preference, 3,000 6 per cent. preference and 3,000 ordinary shares of £1 each. Return dated March 26th, 1929. All shares taken up. £9,900 paid, £100 considered as paid. Mortgages and charges: £1,200.

Park Electrical & Engineering Co., Ltd.—Mr. F. W. Palmer, of 74, Wellington Road, Oldham, ceased to act as receiver on July 26th, 1929, and Mr. E. A. Chambers, of 40, Brazennose Street, Manchester, was appointed.

Northern Counties Electricity Supply Co., Ltd.—Capital, £200,000 in £1 shares. Return dated April 3rd, 1929. 194,201 shares taken up. £190,202 5s. paid on 190,201 shares (including £1 5s. paid on 10 forfeited shares). £4,000 considered as paid on 4,000 shares. Mortgages and charges, £187,947.

Loch Leven Electricity Supply Co., Ltd.—Capital, £10,000 in £10 shares. Return dated March 26th, 1929. 500 shares taken up. £5,000 paid. Mortgages and charges, nil.

"Sel-Ezi" Wireless Supply Co., Ltd.—Capital, £500 in 400 preference shares of £1 each and 2,000 ordinary shares of 1s. each. Return dated May 2nd, 1929. 270 preference and 2,000 ordinary shares taken up. £370 paid. Mortgages and charges, nil.

M.S.L., Ltd.—Capital, £500 in £1 shares. Return dated April 19th, 1929. All shares taken up. £500 paid. Mortgages and charges, nil.

Six-Sixty Radio Co., Ltd. (formerly the Electron Co., Ltd.).—Capital, £1,000 in £1 shares. Return dated June 25th, 1929. 970 shares taken up. £970 paid. Mortgages and charges, nil.

Electrical Distribution of Yorkshire, Ltd.—Capital, £1,500,000 in £1 shares. Return dated March 19th, 1929. 800,000 shares taken up. £800,000 paid. Mortgages and charges, nil. Return of allotments, made up to April 16th, 1929, shows a further 600,000 ordinary shares allotted, payable in cash, and fully called up.

Cleveland and Durham Electric Power, Ltd.—Capital, £700,000 in 350,000 preference and 350,000 ordinary shares of £1 each. Return dated April 3rd, 1929. All shares taken up. £619,698 paid on 348,230 preference and 271,468 ordinary shares. £80,302 considered as paid on 1,770 preference and 78,532 ordinary shares. Mortgages and charges, £290,700.

Seaton and District Electric Light Co., Ltd.—Capital, £10,000 in £1 shares. Return dated March 30th, 1929. All shares taken up. £10,000 paid. Mortgages and charges, £6,000.

T.B.T. Electric Co., Ltd.—Capital, £2,000 in £5 shares. Return dated February 27th, 1929. 200 shares taken up. £1,000 paid. Mortgages and charges, nil.

City Notes.

Oliver Pell Control, Ltd.

The annual meeting of this company was held at its Bloomfield Road works on July 30th, Mr. C. Oliver (chairman) presiding. In moving the adoption of the report, the chairman said that the sales and the gross profit had increased, whilst the expenses had decreased, both factors contributing to a considerable improvement of the credit balance carried down from the profit and loss account. During the year it became evident that the arrangements entered into some two years ago with another company, whereby they combined the wireless sales section of the business with the company, were proving unworkable, and it was decided to wind up this joint selling company (R.I. & Varley, Ltd.), which was now being done, and in future the business of Oliver Pell Control, Ltd., including the wireless sales section, would be carried on under their sole control. The general business of the company was unaffected by any arrangements that were entered into in connection with the joint selling company. The only part of the business that was affected was the wireless goods. The offices at Kingsway House, Kingsway, W.C., were being retained, and the showrooms at the same address were being taken over from the liquidator of the old selling company. The other side of the problem, in connection with the wireless goods, was the necessity to produce on a larger scale and so support that portion of the sales organisation which had hitherto been devoting its efforts to the sale of the joint products marketed by the old selling company, and their technical experts had produced a series of products. The facilities at the works to cope with a wider and more extensive business had already been met—a large wing to the main factory had been completed at a cost of over £13,000, and a programme of output had been formulated and manufacture was proceeding, for the winter trade. The other sections of the company's business were good and gradually expanding, and they were making steady headway against competition, which probably became more and more keen in almost every branch of the business. The report and accounts were adopted.

Mexico Tramways, Light, and Power Group.

The annual general meetings of the Mexican Light & Power Co., Ltd., and the Mexico Tramways Co., were held in Toronto on August 2nd, Mr. R. C. Brown (vice-president) acting as chairman. In presenting the report and accounts the chairman referred to the disturbed conditions in Mexico, which had somewhat reflected on the companies' operations, and stated that the trouble was now settled. Construction progress was satisfactory and the properties were being well maintained, so that with the reconstruction of some of the plants and the modernising of the distribution system the companies would be well prepared to meet the natural growth. The report and accounts were adopted.

Wellman Smith Owen Engineering Corporation, Ltd.

The annual meeting was held on August 10th. Mr. F. N. Pickett (chairman), who presided, said that the depression in the iron and steel industries continued, but signs of improvement were shown in the latter half of last year and in the early part of this year. The loss in this year's balance sheet had been greatly reduced as compared with the previous year, and it was due entirely to the conservative "writing off" by the board that there was a loss at all. The company was in a satisfactory position, as the works were fully employed, and the order book for the first six months of the current year showed a great increase over the same period for the previous year. There were indications that this was likely to be continued. The report was adopted.

Tyneside Tramways and Tramroads Co.

The report for the half-year ended June 30th shows that the expenses exceeded receipts by £534, to which is added mortgage and loan interest, &c., making a total deficit of £2,062. An amount of £2,100 is transferred from reserve, which, with a balance of £31 from the previous half-year, leaves £69 carried forward. Traffic receipts decreased by £1,985, as compared with the corresponding period of 1928.

Stock Exchange Notices.

Dealings in the following securities have been allowed by the Committee of the Stock Exchange under Rule 159:—

Allen West & Co.—200,000 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 1 to 200,000.

International Telephone and Telegraph Corporation.—551,939 shares of capital stock of no par value.

West India and Panama Telegraph Co.

The receipts for 1928 amounted to £58,417, and working expenses were £75,243, leaving a debit balance of £16,825. After providing for debenture interest and £3,587 for depreciation and renewals of s.s. *Henry Holmes*, debit to revenue is £24,868, raising the debit balance brought in to £152,401.

Electric Supply Fusion.

The *Daily Dispatch* understands that all the ordinary and preference shares in the Ormskirk Electric Supply Co., Ltd., have been purchased by the Lancashire Electric Light & Power Co., Ltd.

William Beardmore & Co., Ltd.

At a separate general meeting of the holders of preference shares in this company, held on August 6th, resolutions approving the scheme for the reorganisation of the share and loan capital were carried.

Torquay Tramways Co.

An interim dividend has been declared of 4 per cent., free of tax, on the ordinary shares.

Westminster Electric Supply Corporation, Ltd.

The directors recommend payment of an interim dividend of 8d. per share, less income-tax, on account of standard dividend on ordinary share capital in respect of the current year, payable on September 2nd next to shareholders on registers on August 13th.

Stocks and Shares.

Monday Evening.

Stock Exchange markets were sailing along in merry mood, with a buying breeze freshening in a number of the popular departments, and with cheerfulness beaming from the expectation of still better prices to come when money should grow cheaper. Into this pleasant picture the Federal Banks of New York suddenly, and without warning, flung a rise in their Bank Rate, with the result that optimism was nipped in the bud, hopefulness retired well into the background, and money became quoted in double figures. The fear immediately arose that the Bank of England might have to put up its own Rate during the present week. The jar to confidence proved to be very considerable, and, coming as it did on the eve of a fairly heavy Stock Exchange account, the effect was to spread depression and to reduce prices in most of the markets.

The Volte-Face.

At the beginning of this week, a complete *volte-face* occurred. The Bank of England hinted that there will be no rise in its Rate this month unless exceptional circumstances supervene. New York recovered its spirits and its prices. It is argued that American speculators are not going to be deterred from making purchases simply by the fact of call money being 10 per cent. or thereabouts. If the bull can see his way to a probable rise of several dollars in certain industrial shares, he is going to buy them, whether it costs him 5, or 10, or 15 per cent. to finance the operation. There is undoubtedly a feeling of such confidence in the mind of the American investor and speculator that he readily buys whatever shares are considered on the other side to stand a good prospect of improvement. The appreciation in prices which has occurred during the past eight months, as shown in the table given here a week ago on page 248, illustrates the vitality of the market for industrials, and, so far as it goes, justifies the fervent optimism of the purchasers.

Predominant Partners.

Hydro-Electrics touched 81¼ as their recent highest, fell to 70 within a few days, and at 75 are 5 down on the week. International Holdings have fluctuated between 14 and 11. Brazilian Tractions came into eager demand, a report going round to the effect that New York and Montreal were competing against each other in order to secure control of the company. Under the influence of this buying, the price of the shares touched 75, reacted to 70, and recovered to 74. The preferred shares have risen to 215. The stocks in this trio of companies have been leading the market in American Utilities as a whole, and a considerable volume of business has taken place for the account of the professional and semi-professional operators. The public are not doing very much, though the movement, spectacular as it has been in the cases of Hydro-Electrics and Brazilian Tractions, is watched with the liveliest interest.

American Utilities.

The upward reaction in American Utility issues served to advance the price of Montreal Light, Heat and Power shares to 137½, this showing a gain on the week of 16½ points. Pennsylvania Power, on the other hand, fell 7 to 107½. Shawinigan at 102½ are 5 points up. Power Corporation of Canada rose to 123½, and a strong feature was provided by the two stocks of the British Columbia Power Company, the "A" rising to 52, and the "B" to 37. Consolidated Gas and Power of Baltimore are firm at 140. Most of the previous fall became wiped out, the market, as a whole, reassuming its previously bullish appearance, and casting off the apprehension that seized upon it at the end of last week by reason of the rise in American money rates.

Cables and Wireless.

Cable and Wireless stocks are heavy. The depression attacked all three classes, the preference stock falling to 94, the "B" going back 5 to 75½, and the "A" ordinary to 86. It would appear that a somewhat weak bull account had been established on the part of people who had bought the cable stocks and Marconi Wireless shares before the merger became effective, and who have been hanging on to their stocks in

the hope that buyers from America would come and relieve them of their obligations. The Americans having failed to fulfil this expectation, some of the Cable buyers have turned out their stock in sheer disappointment, with the result just mentioned. American Telephone and Telegraph stock has been steady at 285, and International Telephone and Telegraph strengthened to 115. Automatic Telephones and International Automatic Telephones are a dull market at 37s. 6d., this being the season of the year at which prices of both are usually at their lowest curve. Canadian Marconi are 1½, and there has been a little business doing in Burndept Wireless on the basis of 4s. 3d.

Home Railways and Trams.

The Home Railway and Traction group is somewhat dull. No changes have taken place in Metropolitans or in Districts, but the Underground 6 per cent. Incomes went back to 106. Some sinister sentiment, no doubt, inspired the suggestion that there had been a few sales by uneducated people who fail to appreciate the beauty of the company's new Epstein figures at the St. James's Park offices of the Underground. London Tramway and other traction descriptions are disposed to droop. London and Suburban Traction Preference, quoted at 10s., changed hands last at 9s. 6d. The ordinary are 2s. 9d.; both issues are £1 shares. London United Tramways ordinary remain at 5s. 6d. Outside of the London group, British Electric Traction holds its remarkable price of 1,650. It seems strange that no suggestion has been formulated—so far as we know—for splitting the stock into more manageable proportions. Torquay Tramways ordinary shares at 30s. are nominally unaffected by the decision to pay a bonus of 6s. per share, and an interim dividend of 4 per cent. tax free. The bonus arises from a profit of £3 10s. per share made by the Torquay Tramways in selling 15,000 of its Devon General Omnibus and Touring shares, the buyers being the Great Western and the Southern Railway Companies.

Electricity Supply.

Electricity supply shares are, on the whole, a good market, with County of London showing a rise of 1s. 6d. to 55s., Metropolitans being 9d. up at 44s. 6d., and Midland Counties rising to 33s. Bournemouth and Poole have improved to 64s. 6d. On the other hand, there is a fall of 6d. per share in Chelsea Electricity Supply, due to a few shares coming on offer. Northampton ordinary are better at 49s., this being due, it is said, to resumption of buying from America. The list, as a whole, shows a good deal of firmness, in spite of the high money rates now prevailing. In the foreign group, the changes are insignificant. Atlas Light and Power ordinary are quoted at 27s. 6d. British Power and Light have gained a trifle at 16s. 6d. The newly-issued Scottish Power ordinary strengthened to 1s. 3d. premium. Calcutta Electric Supply, wanted for India, hardened to 54s. 9d.

Mexican Matters.

Mexican Light and Power common shares have recovered the fall of 2½ points sustained last week, and this group as a whole shows marked firmness. The fact of the common shares standing at 97½ suggests that the 7 per cent. preferred, at 81½, deserve consideration as a speculative investment, bearing in mind that the common are not in receipt of a dividend. The company's 4 per cent. second preferred shares, of the nominal value of $5, and getting their dividend, are quoted at 3. As a gamble, the common shares of Puebla Tramway Light and Power Company have attracted some little attention by reason of the rises in other Mexican Utility shares, but they are hard to get, the nominal price of 14½ for the $100 shares being viewed in the light of option money. There are only 65,000 in issue, and the company is paying interest on its 5 per cent. prior lien bonds and 5 per cent. first mortgage bonds, quoted at 67½ and 64½ respectively. Puebla is sometimes called the Manchester of Mexico. Mexico Tramways common shares came back to 57½ in sympathy with the reaction in the Anglo-Americans. The last time that Mexico Tramways paid a dividend on its common shares was in October, 1913. The 5 per cent. general consolidated first mortgage 50-year bonds, quoted in our lists, stand at 75, and the company's 6 per cent. 50-year mortgage bonds, which have received no interest for 15 years, are 75 middle.

G.E.C. and Others.

Amongst manufacturing and equipment shares the most interesting movements are the rises which have occurred in General Electrics and in Siemens. These two have risen to 63s. 9d. and 30s. respectively. Vague rumours are afloat in connection with the possible association, in some shape or other, of the two companies, but no particular credence is attached to the reports. Johnson & Phillips are also better, rising 3/16 to £2 per share. Associated Electrical Ordinary at 45s. are, on balance, the same as they were at this time last week. They fell back at one time to 2½, to be rallied by the same persistent buyers who have been taking General Electrics for America. British Aluminium at 47s. 6d. have gained sixpence. In spite of a setback in the price of raw rubber, the share market shows no particular indication of weakening. The iron and steel group is disposed to be dullish, although the amount of business passing nowadays in its principal issues is so comparatively small as to make it difficult to test the actual time of the market.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Aug. 12 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	64/6	+7/6	4 12 0
Brompton Ordinary	1	8½	8½	26/-	—	5 7 8
Charing Cross Ordinary ...	1	8½	8½	26/6	—	5 5 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¾	8¼	25/6	−6d.	5 9 10
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref....	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	26/3	—	... ...
County of London	1	7½	10	55/-	+1/6	3 12 9
do. do. 6% Pref....	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref. ...	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation ...	1	11	11	53/3	—	4 2 8
Kensington Ordinary ...	1	8	8	26/-	—	5 7 8
Lancs. Light and Power ...	1	7½	7½	28/-	—	5 7 2
London Electric	1	8½	9	28/-	—	5 0 0
Metropolitan	1	9	9	44/6	+9d.	4 1 1
do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	33/-	+1/6	3 18 9
Mid. Elec. Power	1	15	8	37/6	—	4 5 4
Newcastle on-Tyne Ordinary ...	1	6	6	27/-	—	4 9 0
do. 7% Pref. ...	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref. ...	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref. ...	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall ...	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	30/-	—	5 6 8
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	37/-	—	... ...
Westminster Ordinary	1	8½	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	26/-	—	4 9 0

Home Rails.

Central London Ord. Assented ...	Stock	4	4	72	—	5 11 1
Metropolitan	,	8	8½	56½	—	6 4 8
do. District	,,	4	5	73½	—	6 16 0
Underground Electric	£1	5	7	22/-	—	6 7 3
do. do. Income ...	Bonds	6	6	106	−1	5 13 2

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 8
do. Def.	,,	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	2	—	6 5 0
Cables & Wireless 5½ Pref.	Stock	—	—	94	−1	5 17 0
do. A 7½ Ord.	,,	—	—	86	−1	... ...
do. B Ord.	,,	—	—	75½	−5	... ...
Globe Tel. and T. Ord.	10	10	10	26	—	*8 17 0
do. do. Pref.	10	6	6	11	−⅛	5 9 1
Great Northern Tel.	10	20	17½	81	—	5 13 6
Indo-European	25	10	10	47½	—	*5 5 3
Marconi-Marine		12½	15	3⅞	—	4 10 8
Oriental Telephone Ord.		12	12	3⅛	—	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	3⅞	—	8 0 0
do. do. 2nd Pref. ...	5	6	6	3½	—	8 11 6
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	,,	5	5	1650	+50	... ...
do. do. Pref. Ord.	,,	8	8	128	—	6 5 0
Brazil Traction	100	7	8	74	+5½	2 14 1
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	92½	—	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/-	—	... ...
London United Tram Deb. ...	Stock	4	4	59	—	6 15 7
Mexico Trams. 5% Bonds	—	5	5	75	—	6 13 9
Mexican Light Common	100	Nil	Nil	97½	+2½	... ...
do. 7% Pref.	100	7	7	81½	—	8 11 10
do. 1st Bonds	—	5	5	79	—	6 6 7
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	2½	—	2 13 4
Babcock & Wilcox	1	13	15	62/6	—	*4 16 0
British Aluminium Ord.	1	10	10	47/6	+6d.	*4 4 4
British Elec. Transformer Pref. ...	1	7	7	13/9	—	9 6 8
British Insulated Ord.	1	15	15	3½	—	4 0 0
Brush Ord.	Stock	10	10	131	—	7 12 8
Callenders	1	15	15	3½	—	4 0 0
do. 6½% Pref.	1	6½	6½	1½	—	5 4 0
Crompton Parkinson. Ord.	5/-	—	—	21	—	... ...
do. 8% Pref.	1	8	—	25/-	—	6 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6xd	—	7 1 3
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4½	—	4 11 4
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	3-7/8	+⅛	8 2 6
Henley	1	25	30	£3	—	4 14 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	13/9	—	... ...
Johnson & Phillips	1	10	—	2	+3/16	5 0 0
Siemens Ord.	1	7½	7½	30/-	+3/-	5 0 0
Telegraph Construction	12	10	10	23½	—	*4 19 3

* Dividends paid free of Income Tax.

Swedish Electrical Imports.

Statistics for 1927 and 1928 Compared.

THE following figures, showing the values of Sweden's imports of electrical and allied goods during 1928, are taken from the recently-published official trade returns. For purposes of comparison the figures for 1927 are given and notes of increases or decreases are made. Particulars of Sweden's electrical exports appeared in our issue of July 26th (p. 167).

	Kroner. Thous. 1927.	Kroner. Thous. 1928.	Kroner. Thous. Inc. or dec.
Accumulators and parts thereof—unmounted cells—			
Total	70	355	+ 285
From Germany	69	338	+ 269
Accumulator plates—			
Total	772	424	− 348
From Denmark	22	18	− 4
,, Germany	688	341	− 347
,, Great Britain	5	8	+ 3
,, U.S.A.	56	56	—
Cells and batteries, wholly or partly mounted—			
Total	895	942	+ 47
From Denmark	15	36	+ 21
,, Germany	443	463	+ 20
,, Great Britain	144	126	− 18
,, U.S.A.	288	304	+ 16
Special apparatus for electrical purposes: Röntgen ray apparatus—			
Total	180	293	+ 113
From Germany	168	273	+ 105
,, U.S.A.	12	—	− 12
Wireless telegraph and telephone apparatus—			
Total	4,804	5,119	+ 315
From Germany	2,556	2,468	− 88
,, Great Britain	646	520	− 126
,, U.S.A.	122	109	− 13
Other special apparatus for electrical purposes—			
Total	3,495	3,884	+ 389
From Denmark	99	129	+ 30
,, Germany	1,921	2,225	+ 304
,, Great Britain	446	1,105	+ 659
,, Switzerland	57	85	+ 28
,, U.S.A.	313	198	− 115
Galvanic cells—			
Total	3,294	3,577	+ 283
From Denmark	1,837	2,020	+ 183
,, Germany	1,280	1,460	+ 180
Generators, motors, weighing not more than 500 kilos each—			
Total	2,026	2,525	+ 499
From Denmark	88	134	+ 46
,, Germany	1,432	1,714	+ 282
,, Great Britain	73	131	+ 58
,, U.S.A.	340	426	+ 86
Ditto, weighing more than 500 but less than 3,000 kilos—			
Total	355	793	+ 438
From Denmark	37	96	+ 59
,, Germany	202	96	− 106
,, Great Britain	41	60	+ 19
Ditto, weighing more than 3,000 kilos—			
Total	143	196	+ 53
From Germany	44	158	+ 114
Transformers, 100 to 500 kg.—			
Total	45	58	+ 13
From Germany	34	32	− 2
,, U.S.A.	3	3	—
Transformers, over 3,000 kg.—			
Total	152	174	+ 22
From Germany	91	140	+ 49
,, Switzerland	61	28	− 33
Metal-filament lamps—			
Total	3,229	3,673	+ [illegible]
From Denmark	35	109	+ 74
,, Germany	1,844	2,188	+ 344
,, Netherlands	1,036	748	− 288
,, Austria	137	120	− 17
Lamp sockets, with and without switches—			
Total	422	461	+ 39
From Germany	401	433	+ 32
Insulating tubes, steel armoured—			
Total (all from Germany)	10	13	+ 3
Insulating tubes, other kinds—			
Total	335	537	+ 202
From Germany	334	536	+ 202
Carbon, not specially mentioned, manufactured for electrical purposes, weighing 3 kilos or more—			
Total	944	1,159	+ 215
From Germany	483	504	+ 21
,, U.S.A.	421	619	+ 198
Carbon brushes—			
Total	106	85	− 21
From Germany	22	20	− 2
,, Great Britain	61	52	− 9
Carbon: Other kinds—			
Total	237	233	− 4
From Germany	157	174	+ 17
,, U.S.A.	56	34	− 22
Starting, regulating, and reduction resistances, controls, and other electric regulators—			
Total	182	139	− 43
From Germany	140	118	− 22
Bases for incandescent lamps—			
Total	77	94	+ 17
From Germany	20	32	+ 12
,, Netherlands	57	62	+ 5
Stators, rotors, current collectors, magnet coils, &c., weighing not more than 50 kilos—			
Total	334	518	+ 184
From Denmark	9	16	+ 7
,, Germany	249	416	+ 167
Current interrupters and reverses, oil brake switches, hand-operated—			
Total	44	77	+ 33
From Germany	35	53	+ 18
Box, knife and other switches—			
Total	1,057	1,318	+ 261
From Germany	855	1,068	+ 213
Safety appliances, not specified—			
Total	760	831	+ 71
From Germany	741	815	+ 74
Electricity meters—			
Total	1,139	1,197	+ 58
From Germany	1,052	1,059	+ 7
,, France	61	72	+ 11
Other electrical measuring instruments—			
Total	555	630	+ 75
From U.S.A.	50	52	+ 2
,, Germany	446	501	+ 55
Porcelain insulators, conduit pipes, &c.—			
Total	601	643	+ 42
From Denmark	7	9	+ 2
,, Germany	582	509	− 73
,, U.S.A.	7	87	+ 80
Cables and cords with sheaths of lead or other metal; maximum diameter 25 mm.—			
Total	746	783	+ 37
From Denmark	101	76	− 25
,, Germany	593	679	+ 86
Ditto, of greater diameter—			
Total	1,491	1,327	− 164
From Denmark	67	99	+ 32
,, Germany	1,406	1,227	− 179
Ditto, not specified—			
Total	955	1,638	+ 683

(£1=about 17 kr.)

Electricity Supply in Java.

Some Notes on Hydro-Electric Developments in the Dutch East Indies.

THE steadily increasing use of electricity by both individuals and industrial undertakings in the larger towns on the island of Java, Dutch East Indies, and the expansion of the electricity supply system to even the smallest towns and districts has greatly augmented the demand for electrical energy. On the one hand, as the Dutch East Indies are without the advantages of coal fields, there are but few steam power stations, they being only found in a few of the larger towns on the coast; for instance, in Soerabaya and Batavia. On the other hand, many inland towns which are not situated near water power resources have Diesel-engined stations, as excellent fuel oil can be won at different places in Java, Sumatra, and Borneo.

In the mountainous districts there are excellent opportunities for harnessing water power, and an important step in the electrification of Java was the construction of hydro-power stations and the erection of an extensive 70,000-V network in West Java for supplying Batavia, Buitenzorg, and the surrounding district, as also the electrified main railway between Tandjong, Priok, Batavia, and Buitenzorg. Further, a number of State-owned hydro-electric power stations are in operation in West Java in the vicinity of Bandoeng, which supply the plateau with power at 25,000 V.

In the east of the island the distribution of electricity is in the hands of the Algemeene Nederlandsch-Indische Electriciteit-Maatschappij (Aniem), a company that has always played a prominent part in the electrical development of the Dutch East Indies. In 1926 the company amalgamated with the Government and a new company, known as the Nederlandsch - Indische Waterkracht Exploitatie - Maatschappij (Niwem), was inaugurated. Its main purpose was the erection and operation of hydro-power stations on the river Kali-Konto, to the south of Soerabaya. The harnessed water power of this river will enable three separate stations to be built for an aggregate output of about 100,000 h.p. The Mendalan power station and the first three sub-stations at Soerabaya, Modjokerto, and Blimbing, together with the 70-kV line connecting them, were initiated in 1926 and completed in June, 1928. On putting this network into commission, the Semampir steam power station near Soerabaya and the Malang Diesel station were converted into stand-by stations. The Bangil sub-station and the 70-kV line extending from Blimbing to Bangil were completed last year, and have enabled the Pasoeroean Diesel station to be put on stand-by service. The ring main will be completed eventually by an overhead line between Bangil and Soerabaya, whilst a second ring to the south is also being planned.

At present the initial capacity of the central station at Mendalan is 16,200 kW, which is generated by three 5,400-kW sets; the ultimate capacity will, states the *Far Eastern Review*, be approximately twice as great. The major part of the energy now generated is consumed in the town of Soerabaya, a 70-kV double-circuit overhead line connecting the Mendalan power station with a sub-station in Soerabaya. The latter houses three 4,000-kVA, 70/6-kV transformers. A small 70/6-kV sub-station of an aggregate output of 1,000 kW has also been erected at Modjorkerto, situated between Mendalan and Soerabaya.

The 70-kV network is to be developed into a complete ring. The return line from Soerabaya to Mendalan will also be of the double-circuit type, and will be interconnected with the two sub-stations at Bangil and Blimbing. At present the line from Mendalan to Blimbing is an ordinary three-phase circuit with a fourth reserve conductor, which will ultimately form one of the conductors of the second three-phase circuit. The present capacity of the sub-station at Blimbing is 3,000 kW. When completed, the entire length of the 70-kV lines will be about 125 miles. The A.E.G. supplied the three 7,000-kVA, 6/70-kV, main transformers for the Mendalan central power station, the two 500-kVA, 70/6-kV transformers for the Modjokerto sub-station, including the switching plant for the central station and all the sub-stations. The network is equipped with a complete system of distance relays and earth leakage relays, as well as Petersen "arcing ground suppressors" and five sets of 70-kV Bendmann excess voltage arrestors.

As the plant had to be specially designed for extremely severe tropical conditions, it includes many interesting features not to be found in plant in European countries. When building the outdoor transformer station account was taken of this fact by allowing for ample insulation and fitting special spark-gaps on the bushings of the apparatus, &c. The steel structure and apparatus are all galvanised, the supporting structure and smaller parts being hot-galvanised and the large oil tanks treated by a spraying process. That special protective measure was essential, as the usual coat of rust-proof paint is not able to withstand heavy rain and intensive sunshine immediately following.

In addition to the East Java 70-kV network above referred to, the older 70-kV West Java network, which is under the management of the State-owned "Waterkracht en Electriciteit" company, also plays a prominent part in supplying the Island of Java with electricity.

Water Power in Norway.

Recent State and Private Developments.

IN a recent report upon conditions in Norway transmitted to the Department of Overseas Trade by Mr. C. L. Paus, C.B.E., Commercial Secretary at Oslo (Stationery Office, 2s. net), some details of hydro-electric development are given.

Mr. Paus states that the first stage of the Government scheme to harness the waterfalls at Nore was completed in the summer of 1928, when the plant, which can produce 66,000 kW delivered at the sub-stations, was taken into use. By further regulation of the watercourse and the installation of additional sets the output of power can be doubled. A total of kr. 56 million has hitherto been expended on the scheme, including transmission lines and sub-stations. The scheme of the Bergen Municipality for the export of water power at Dale was completed, and the supply of energy commenced, early in 1928. The present machinery has a capacity of about 22,000 kW, which can be doubled later, or increased to about 66,000 kW by the transfer of water from Torfinno. The Maudal Inter-municipal Power Co. was granted a concession on August 17th, 1928, to regulate the Maudal watercourse in Rogaland and has begun to construct a power station for about 3,000 kW, which may subsequently be increased to 6,000 kW.

In 1925-26 the Crown was authorised to grant loans, to a total of kr. 5 million, to municipal electricity works labouring under financial difficulties, and, as cover for these loans in the event of non-repayment, sums of kr. 3 and kr. 2 million, respectively, were included in the State budget estimates of expenditure during 1927-28 and 1928-29. The estimates for 1928-29 also included a sum of kr. 2 million as cover for a loan advanced to the municipality of Aust-Agder in 1928. In addition to this, an expenditure of kr. 600,000 in 1927-28, and kr. 400,000 in 1928-29, was authorised to cover loss of interest, &c., on State-guaranteed loans advanced to municipal electricity works. The estimated expenditure in 1929-30 for the same purpose is kr. 300,000.

No important private power schemes were initiated or completed in 1927 and 1928. Work is, however, proceeding on the construction of a new power plant at Saude, where machinery capable of producing about 40,000 kW is to be installed. The power company, A/S Saudefallene, is controlled by the Electric Furnace Products Co. The question has also been raised of harnessing a watercourse in the neighbourhood of Narvik, for public or private account, with a view to the delivery of power to the Ofot Railway and the town of Narvik. The capacity of the plant would be 10,000 to 20,000 kW at first, with the possibility of expansion later. Under the terms of a concession to acquire the Kinso watercourse, which was granted to A/S Kinservik (controlled by the Aluminium Company of America) on May 14th, 1926, it was provided that half the power should be harnessed by January 17th, 1929. By a Royal Resolution of December 21st, 1928, the period within which this condition must be fulfilled was extended until January 17th, 1934. The unsatisfactory state of the aluminium market was cited in favour of the extension.

The progress made of recent years in the use of steam power for the production of electrical energy has attracted considerable attention in view of the arrested development of Norway's supply of natural water power, and the subject was discussed in November, 1928, at a meeting in which all the interests concerned took part. It was then pointed out that, whereas the efficiency of steam plant had practically doubled, while the price of plant and costs of production had been materially reduced, machinery for producing hydro-electric energy was only from 10 to 15 per cent. more efficient and its cost had actually risen. Norwegian water power possessed possibilities unsurpassed in any other country, but its exploitation was obstructed owing to the restrictions and conditions imposed by the concession laws. The meeting was of opinion that those laws should be amended according to present-day requirements, and a committee was appointed to advance proposals for the necessary modifications.

A French Television Association.

The Association Française de Télévision has been formed with headquarters at 5, Rue Malakoff, Paris. Mr. E. Belin is the president of the new body, the object of which is to advance the television movement in France.

A Mill-driving Installation.

A Description of the Electrical Equipment at the New Mill at Oldbury of the Bromford Iron Co.

SOME few years ago the construction of a new mill at the Bromford Iron Co.'s works at Oldbury was undertaken, and it is thought that some particulars of the electrical installation may be of interest. The chief electrical problem was in connection with the supply of upwards of 800 kW to the new mill house, situated at a considerable distance from the works power house, for a hoop mill driven by a 1,000-h.p. motor which, together with its automatic starter, was manufactured by the General Electric Co., Ltd.

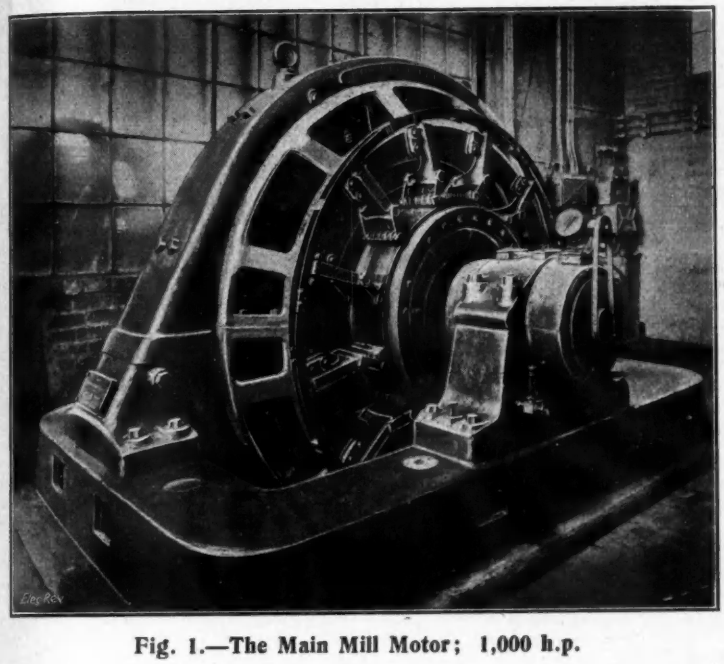


Fig. 1.—The Main Mill Motor; 1,000 h.p.

Hitherto the supply available at the iron works had been at 220 volts, derived from two 500-kW d.c. generators coupled in tandem through gearing to a Parsons turbine. The distance to the new mill made it necessary to increase the supply pressure, and that was done by running the two generators in series. The problem was complicated, however, by the fact that there were already motors of considerable size running on the 220-volt supply, the balancing of which on the new 3-wire system required careful planning in order to avoid overloading one side of the system, while special arrangements had to be made to enable the engine-driven standby set, which is used for a supply of power for auxiliaries at week-ends and during holidays, to supply either side of the system when required.

In order to convert the original installation into a 3-wire system it was necessary to reconstruct the main switchboard, and this part of the work had to be undertaken without interruption of the supply. The principal difficulty experienced was in the reconstruction of the busbars and connections in the short intervals when the power was not required. Much of the work was, in fact, carried out with the board alive. It is interesting to note that the whole of the electrical reconstruction work, which involved the dismantling, alteration and adapting of much existing gear and material, was carried out to specification on a contract basis.

The earthing of the neutral was effected through a fusible cut-out in parallel with a 5-ohm resistance, this apparatus being mounted on a special control panel to enable a check to be kept on serious earth faults. This panel carries two voltmeters connected, respectively, between the neutral and outer bars, with a 2-way switch to enable the voltage of either generator to be read before switching the machine on to the busbars. There is a link in the earth circuit, and a red lamp is connected in parallel with the cut-out and resistance to indicate if the former is blown. The supply is taken to the mill by means of an overhead line 120 yards long, controlled by a special panel equipped with ammeters in the outer and mid-wire circuits, the instrument in the latter being of the centre-zero type: a d.p. main switch is connected in the outers, while the mid-wire can be isolated by means of a link. The outer conductors of the overhead line consist of four 0.6-sq. in. cables per pole, these being of hard-drawn copper, double braided and compounded. The middle wire is of .04-sq. in. section. Some idea of the stress which the use of cables of this size entails may be gathered from the fact that the terminal poles have to resist a horizontal pull of 19 tons at a temperature of 22 deg. F., and at a height of 16 ft. 6 in. from the ground level. At the mill end the cables are taken into the building through earthenware leading-in tubes, and are connected directly to the starting gear of the main mill motor, the middle wire being connected to two distribution boards supplying, respectively, the auxiliary motors and lighting circuits. The outers feeding these boards are extended from the starting gear terminals of the main motor.

The hoop mill is of advanced design, and consists of eleven stands of rolls, the breakdown rolls being arranged in tandem and the finishing rolls looping. The rolls are driven practically throughout by cotton ropes, and the final stand of rolls is driven directly by ropes from the main rope wheel, independently of the other rolls. The strip rolled varies from ¾ in. to 2¼ in. wide, and all gauges down to No. 20 are dealt with. The furnace is of the continuous type fed by an electrically-driven pusher. The main mill motor, fig. 1, is capable of a speed range on full load of 240 to 400 r.p.m. by shunt regulator control. It is designed on generous lines,

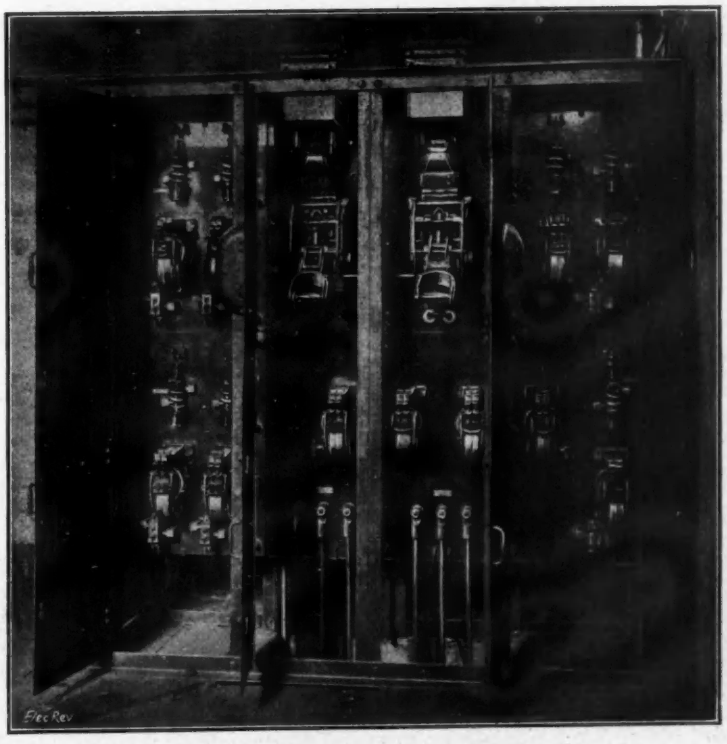


Fig. 2.—Fully-automatic Starting Panel.

is compound wound, and a diverter is provided across the series winding to enable the characteristics to be adjusted. The requirements of the mill demand a comparatively small variation in speed from no load to full load. Originally it was specified that the range of speed, no load to full load, at the lowest speed setting should not exceed 2 per cent., but this was afterwards increased to 4 per cent., as it was found that the current taken to enable the machine to maintain its speed against fluctuations of mill resistance was somewhat disturbing to the system.

The starter panel, fig. 2, is of the G.E.C. fully-automatic type, starting and stopping being effected by push buttons situated in the mill. It works between constant limits of current throughout the accelerating period, a series of 6 sets of relay-controlled, solenoid-operated contactors being employed to provide acceleration automatically at an approximately constant rate. From a consideration of the inertia and friction of the mill it was found that the motor could be started and accelerated up to normal speed in 1½ min., with a current peak on each step not exceeding half full-load value, the relays being designed so that the current falls to about ¼ load before the next step is engaged. This method, of course, introduces the difficulty that, should the mechanical resistance to starting for any reason be increased, the motor might continue indefinitely running on the starting resistance at any value between one-half and one-quarter of full-load current, a state of affairs which would burn out the resistances. It was therefore necessary for the time lags to be carefully designed and adjusted, so that while they would give a sufficient time margin for normal starting conditions, they would trip out the main circuit breaker if the current failed to fall to the predetermined value within a certain interval. Actually, on a 1¼-minute starting basis and with six steps, the normal accelerating period for each step is 18 sec., and the relays are designed so that a sustained current value of about 460 A, or just above the lower limit, would trip the main circuit breaker in from 50 to 60 seconds. For any higher value, the time would, of course, be correspondingly reduced. Needle valves are provided in the oil dash pots by which adjustment of the time interval can be effected. This method of overload protection has proved entirely satisfactory in use, and its efficacy has been demonstrated on several occasions when, owing to some untoward occurrence, the automatic starting operation has been suspended for a time temporarily.

The scheme was designed by and carried out under the superintendence of Messrs. Moffett, Rosher & Mann, consulting engineers to the Bromford Iron Co., Ltd. Messrs. Reynolds and Bradwell were responsible for the reconstruction of the switchboard and the cable work.

The Scottish "Grid."

The Central Scotland portion of the national electricity transmission system has made history, not only because it involved the use of a higher voltage than had ever been adopted in the British Isles before, but also because it marked the first step towards the standardisation of the supply frequency throughout Britain.

ANOTHER important date in the annals of British electrical engineering practice was May 9th, 1929, when the first section of the national 132,000-volt "grid" scheme of electrical power transmission between Bonnybridge (Stirlingshire) and Dalmarnock (Glasgow) was made alive for the first time.*

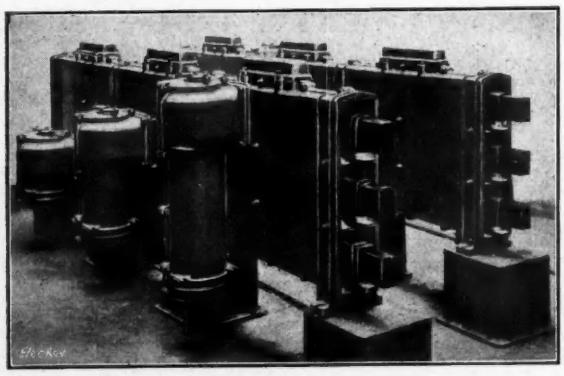


Fig. 1.—Metal-clad Bus-bars.

Hitherto the 66,000 volts used on the Newcastle-upon-Tyne Electric Supply Co.'s system had been the maximum transmission pressure employed in the British Isles, but that pioneering effort has now had to give pride of place to the newer scheme.

Mr. A. E. McColl, district engineer in Scotland for the Central Electricity Board, by closing a Reyrolle circuit-breaker and energising a Ferranti step-up transformer at the Bonnybridge end, made that length of line of about 20 miles to Dalmarnock alive at 132,000 volts. The pressure was increased to 145,000 volts for test purposes, and everything proved satisfactory. The overhead line is now working under its normal conditions at 132,000 volts.

Bonnybridge, under the scheme, will become an important switching centre on account of its geographical position. The network linking the large power houses in the east, west, and north will feed into it; to the north there are the power houses at Dunfermline and Dundee, while later that of the Grampian scheme will be connected also; to the east there is the Portobello station of the Edinburgh Corporation, while to the west there are the still larger power houses at Dalmarnock (Glasgow Corporation) and Clyde's Mill and Yoker (Clyde Valley Electrical Power Co.).

The feeder now working is that between Dalmarnock and Bonnybridge, and its completion was the first step towards the standardisation of the frequency of electricity supply in the United Kingdom. The systems in the west are of 25 cycles: to allow 50-cycle supply to be inaugurated entailed the re-winding of one of the old generators and the installation of a complete set of duplicate bus-bars at Dalmarnock; the switchgear there was supplied by Messrs. A. Reyrolle & Co., Ltd., in 1919, its metal-clad construction enabling the additions to be made without interfering with the existing 25-cycle supply.

Circumstances necessitated the completion of the switchgear additions in 5¼ months from the date of the order, which was accomplished without any hitch. The magnitude of the operations and the speed with which the work was accomplished can readily be appreciated from the photographs reproduced herewith. Fig. 1 shows one length of the metal-clad bus-bar as supplied; over 100 lengths were supplied, exceeding 200 tons in aggregate weight. Fig. 2 illustrates a block of 14 Reyrolle circuit-breakers at Dalmarnock; there are 44 of them installed.

This scheme of bus-bar duplication has rendered the change-over from 25 to 50 cycles comparatively easy, and experience with several of the 20,000-volt feeders radiating from Dalmarnock has already proved it to be not so difficult as was at one time anticipated.

Fig. 2.—A Block of 14 Circuit Breakers at Dalmarnock.

* See Electrical Review, May 17th, 1929, pp. 859 and 870.

A Large Electric Lift.

The passenger lift recently installed in the Westminster Cathedral Tower is claimed to be one of the highest in Europe.

THE electric lift recently installed by Messrs. Marryat and Scott, Ltd., in Westminster Cathedral tower serves from the ground level to the campanile, a distance of 185 ft. From there, a short flight of steps leads to a gallery,

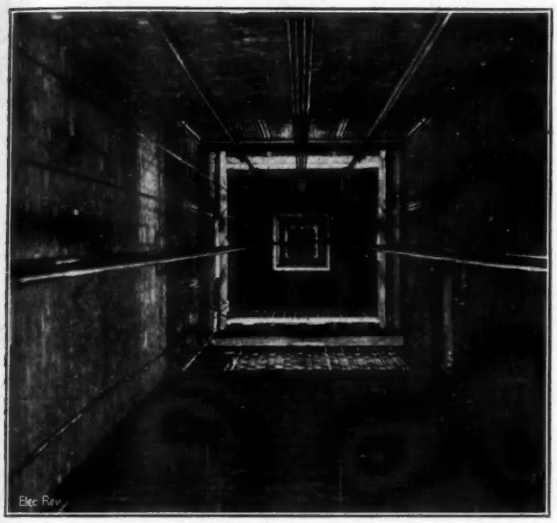


Fig. 1.—Looking up Lift Shaft.

which is claimed to be the highest vantage point in London, whence, on a clear day, it is possible to see the whole of the environs of London and to pick out the various landmarks in the country for miles around.

The lift, which has taken seven months to install, was opened to the public on July 31st. It is built to carry ten passengers at a speed of 350 ft. per minute. This speed is obtained in a distance of 12 ft., and the acceleration is very uniform. Elaborate precautions have been taken to ensure the safety of passengers.

The driver has under his control means for effecting adjustments and replacing fuses without leaving the cabin or calling in extraneous aid. His control switch is fitted with warning pilot lights indicating abnormal conditions, and even in the event of the total failure of the electric current the machine may be driven by hand-power to the nearest floor, so that the most nervous passenger need have no hesitation in making the journey, which, for most Europeans, is a unique experience.

Some idea of the magnitude of the task, which was carried out entirely by British engineers with British material, may be gathered from the following facts: the steelwork supporting the lift weighs 72 tons; the polished round steel guides are 3 in. in diameter, and weigh 2¼ tons each; the flexible steel lift ropes weigh over 6 cwt., and should they stretch unduly, or break, both the car and the balance-weight would be supported on the guides by specially designed safety gear. The lift is driven by a 25-h.p. motor supplied from the 3-phase a.c. mains of the Westminster Electric Supply Corporation.

The lift is controlled by the attendant travelling in the car, fig. 3, by means of a special car-switch, in which are incorporated several unique features. In the detachable self-centring dead man's handle, the handle proper forms the key for the inner cage gate, which is, and must be, locked during a journey. The car switch is suitably marked for "Up" and "Down" directions, with slow and fast speeds in either direction. Below the normal car switch, but mounted integral with the switch, are two emergency buttons. One button, by a momentary pressure, replaces the triple-pole circuit breaker in the motor room, should the breaker open as the result of an overload or earth defect on any one of the phases. The other button closes the circuit normally carried through the exterior landing gates and the cage gates. This button may be depressed should a defect occur in the landing locking system while a journey is being made, which defect would bring the car to rest. A journey made under these emergency conditions can only be made at the low speed, and a warning red light appears behind a suitable lens mounted in the car switch. When the lift is at rest at any floor the red light shows. When the landing and cage gates are closed, a green light shows, indicating to the driver a normal safe running condition. The driver is in telephone communication with the lift motor-room, and with the porter's entrance lodge in the hall.

The car is fitted with a governor-operated delay-action gradually-applied super-grip-type safety gear. Should the governor actuate, owing to the overspeeding of the lift cage through any cause, the current is first switched off the motor; the super-grips are then gradually applied to the guides, the cage and its load being firmly supported on the guides. Fig. 1 is a particularly interesting view looking up the lift shaft.

The landing gates, in addition to being electrically and mechanically locked, making it impossible for a landing gate to be opened unless the car is opposite that floor, and for the lift to move unless the gates are closed, are mechanically locked by the closing of the inner cage gate. This is done by a ramp or cam constructed on the parallel-ruler principle, which is withdrawn mechanically as the cage gate closes.

The winding engine, motor, and controller, fig. 2, are situated immediately above the lift shaft, and the drive is transmitted to the car by means of four flexible steel-wire ropes, in the normal traction-sheave manner. The exceptionally long length of lifting rope is compensated for by a heavy chain, anchored at one end to a point approximately half way up the lift shaft, and at the other end to the under-carriage of the car. The motor, which was supplied specially for the job by the British Thomson-Houston Co., Ltd., is of the three-phase brush-moving type. Coupled to the worm-wheel shaft is a frictionally-gripped drum which rotates the motor brushes

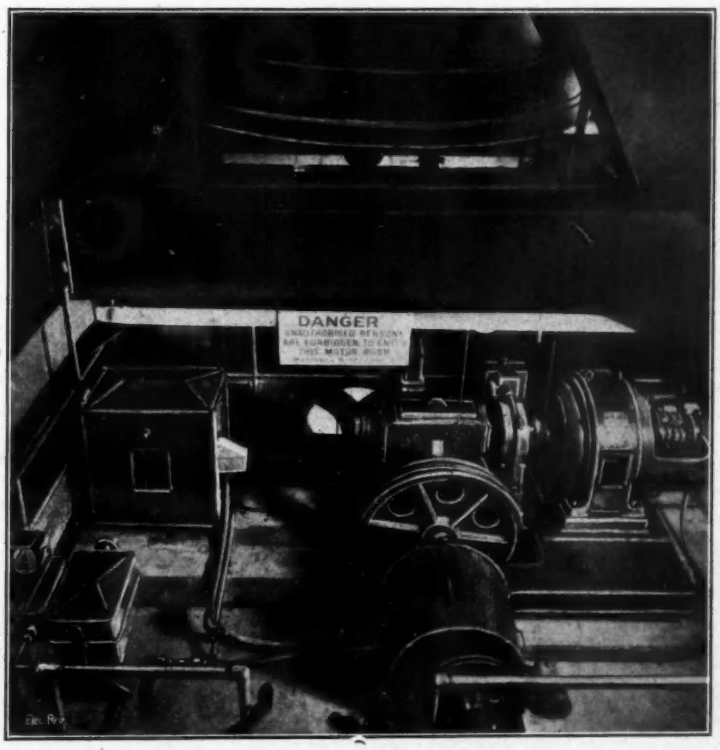


Fig. 2.—Winding Motor and Controller.

to the fast speed in a definite time period; the deceleration is accomplished by the return of the brushes to the slow position by a balance-weight descending in a liquid-retarded dash-pot.

Messrs. Marryat & Scott, Ltd., were responsible for the whole installation, and are to be congratulated on the way they have overcome unusual difficulties with which they were faced. Special precautions have had to be taken to guard against the elements in the exposed motor-room at the top of the tower. The alignment of the cage guides, which are 3 in. in diameter, each weighing over 2 tons, was an achievement. Special means have been adopted for ensuring adequate lubrication of all bearing surfaces in vastly varying tempera-

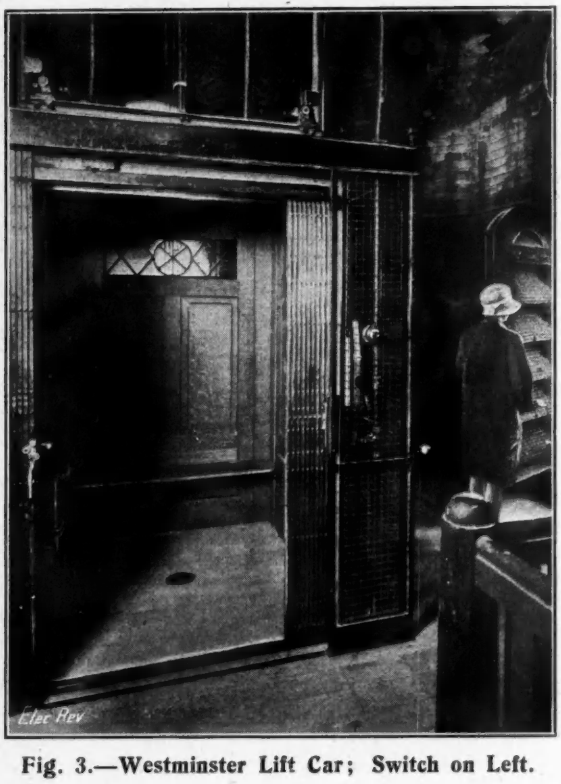


Fig. 3.—Westminster Lift Car; Switch on Left.

tures, by centrifugal action. Considering the "live" nature of the tower itself, which deflects considerably in the wind, the conspicuous absence of vibration in the lift is particularly satisfactory. Another point of interest bearing on the difficulties which Messrs. Marryat & Scott were faced is that the bell in the tower, fig. 2, had to be raised 15 ft. in order to make room for the motor and controller.

The installation was carried out under the supervision of the Cathedral architect, Mr. L. H. Shattock, A.R.I.B.A.

Factories and Workshops Report.

Observations of H.M. Inspectors during 1928.

THE annual report of H.M. Chief Inspector of Factories and Workshops for 1928* draws attention to the considerable expansion in industry in the south of England, as compared with the north, particularly in the neighbourhood of London, and instances the 150 per cent. increase in population between Acton and Slough during the past five years, and the tendency to close small establishments, owing to the economic advantages of concentration in large well-equipped factories.

Accidents.

The total number of accidents reported was 154,319, including 953 fatalities, which figures represent a slight improvement over the previous year. Of these accidents 427 and 26, respectively, were due to electric shock, the former number being an increase of 15 per cent. over the 1927 returns, while fatalities were reduced by one. This increase in non-fatal accidents has (the senior electrical inspector states) no special significance as the number has been exceeded in several previous years and is no higher than it was 15 years ago, in spite of the very much greater use of electricity now, a result attributed to the effect of the regulations and inspection. Nevertheless, not all electrical apparatus described as of the "Home Office type" complies with the official regulations. The fatality rate per 1,000 accidents is 19 for electrical generating stations, which come second to buildings, whose rate is 40. In one accident out of every ten, in all classes, the injury became septic—a high figure, considering that first aid equipment is compulsory in every factory. There is proof that accidents have been reduced in individual factories by organised safety work. In this connection the new Home Office industrial museum has set an example and stimulated a desire to raise standards. It has been visited by manufacturers of machinery, and, in particular, by makers of electrical apparatus, with a view to improving their own products from the point of view of safety.

Lighting.

The series of lighting tests recommended by a departmental committee were continued. Tests in the cutlery factories of Sheffield indicate that the majority of firms give little attention to the proper distribution and shading of lights. The standard of illumination in the engineering trades for fine work is described as very low, in many cases below 5 foot-candles, even when accuracy to within one-thousandth of an inch is requisite. At least one fatality in a mill yard is attributed to inadequate lighting. On the whole, however, there is abundant evidence that much more interest is being taken by employers in general in the question of lighting.

Electric Accumulators.

The senior medical inspector reports that the number of cases of lead poisoning (33) notified was the lowest for many years, although this appears not to be due to any lessening in activity. The largest proportion (11) occurred in the pasting and mixing processes. The majority of the cases were notified from the smaller works, where it is difficult to comply with the regulations with the efficiency observed by the larger firms. The medical inspector considers that, whatever regulations may be applied, accumulators of the usual lead type cannot be manufactured without some risk of lead poisoning.

Electrical Inspector's Report.

A large part of the report of the senior electrical inspector, Mr. G. Scott Ram, O.B.E., M.I.E.E., is devoted to accidents. Of the 427 accidents (26 fatal) reported, 34 (7 fatal) occurred on high-voltage systems, 23 of these (7 fatal) in public supply or traction stations. In most cases men of competence and experience were responsible, and suffered for momentary forgetfulness or lack of care. It is often not realised by the occupier of premises that he is responsible for the safety of a contractor's workman if a switchboard is in use for the occupier's purposes. Three non-fatal accidents were due to the explosion of switches and six in testing departments of electrical manufacturers. On medium- and low-voltage systems 40 accidents (2 fatal) occurred to men working at live switchboards; in many cases there was no need for the carrying out of the work whilst the boards were alive. Other accidents were:—25 (one fatal) due to the working on or near live conductors other than at switchboards, 52 at motor control panels and other switches, 22 in renewing fuses (mostly with live metal exposed), 16 (two fatal) at motors (one due to breaking of earth-wire).

There were also 37 accidents from shock (3 fatal) in the handling of portable apparatus (16 drills and other tools and 11 hand-lamps), chiefly due to non-earthing. Fatalities from this cause occur every year on account of the ease with which a portable lamp can be improvised by anyone having a very slight electrical knowledge. Flexible connectors for portable apparatus accounted for 54 accidents (one fatal). Of these 12 were due to the use of adaptors and other unsuitable plugs, and 26 to the use of inferior or damaged flexible leads.

Cranes and hoists were responsible for 37 accidents (5 fatal). Absence of or faulty earthing accounted for eight of such cases, including five fatal ones, and contact with live trolley wires of cranes for another 20 cases (one fatal). Accidents from inadequately protected conductors amounted to 31 (two fatal); one of the fatal cases occurred in a building under construction, where it is difficult to provide proper protection.

Emphasis is once again given to the danger of connecting tumbler switches in the neutral conductor, instead of in the phase wire; the only sure way of guarding against a mistake of this kind in wiring is to provide double-pole instead of single-pole switches.

A table is included showing the number of fatal accidents at various voltages. At low pressure (not exceeding 250 volts) 17 of the 26 fatal accidents took place, in every case with alternating current. The danger arising out of the use of temporary wiring is such that, in the case of some building operations, the use of a motor generator to convert the supply from the public mains to 110 volts d.c. has been advocated; this follows the common practice in many shipyards for temporary work. Outdoor sub-stations come in for a certain amount of criticism. In some, the designers have not realised the requirements of the regulations regarding safety in operation in such necessary work as the renewal of fuses; in others, which deal with a duplicate supply and are arranged with hospital bars or by-pass to allow an oil switch or other apparatus to be worked upon without shutting down more than a small portion of the station, the provision of adequate spacing is often overlooked. Precautions which are taken as a matter of course in indoor sub-stations are often omitted altogether in the outdoor type, although the danger is greater, since an attendant may have to carry out his work at night in semi-darkness or in a gale of wind and rain. While it is desirable to keep the cost of outdoor sub-stations as low as possible, the collecting together of

* H.M. Stationery Office, Cmd. 3360. Price 2s. 6d. net.

apparatus in a haphazard manner is not the way to achieve the required result. A great deal of the apparatus put on the market demonstrates a complete lack of practical operating experience on the part of the designers, who do not always realise that most of the trouble with outdoor equipment is experienced in bad weather. When oil-filled switchgear is used, it seems doubtful whether a completely outdoor type of sub-station furnishes the best arrangement. One large undertaking in the Midlands experienced so much trouble last winter with outdoor sub-stations that it is superseding them by sub-stations having switchgear within buildings, while retaining the outdoor transformers. The latter type of sub-station is also tending to supersede the kiosk, operated from the outside. Mention is also made of the large capacity of some works generating stations, whose capacity in some cases exceeds that of many public supply undertakings. One under construction in the North of England will be of 100,000 kVA capacity, and a paper mill turns out 200 million kWh per annum, about equal to the output of the Sheffield municipal undertaking.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

Cell-testing Instruments.

The "Hoyt" cadmium cell tester, fig. 1, which is marketed in this country by Messrs. FREDK. J. GORDON & Co., LTD., 92, Charlotte Street, W.1, not only enables the battery users to make cadmium tests, but, it is claimed, is also suitable to take ordinary readings of the voltage of the cell. It is applicable, not only to house lighting batteries, but also to motor-car and wireless batteries. The dial is very clearly calibrated, and the movement is of the dead-beat moving-coil type of great accuracy.

Fig. 1.—The "Hoyt" Cadmium Cell Tester.

A recent introduction of Messrs. FERRANTI, LTD., Hollinwood, Lancashire, is a new cell-testing voltmeter, fig. 2. This consists of a 2½-in. dial and 2½-in. scale moving-coil voltmeter mounted on a special base and fitted with handles and spikes for the convenient testing of battery cells. The instrument is of B.S.S. first-grade accuracy, and consumes only five milliamperes for full-scale deflection. It can be supplied with scales of 0-3 V or 3-0-3 V. On the 0-3-volt scale, provision is made for a negative reading of 0-0.3 volt (marked in red on the dial) to enable cadmium tests to be made in addition to ordinary tests. Robustness is an outstanding feature of the instrument, and it has been designed to withstand unusually heavy overloads without injury. The instrument case is of non-corrodible insulating material, as also are the two handles, to each of which is fitted a rustless, non-corrodible spike, the handles being connected by a two-foot length of acid-proof flexible cable. If required, barbed-type spikes can be supplied instead of the single spike pattern illustrated.

Fig. 2.—"Ferranti" Cell-testing Voltmeter.

A New Lampholder.

Several distinct innovations are claimed for the new push-bar lampholders produced by MESSRS. H. E. ASHDOWN (BIRMINGHAM), LTD., Perry Barr, Birmingham. The device is entirely British made. The chief feature is that the entire switch mechanism is fitted into a bakelite moulding, which in itself forms a complete and self-contained unit, thus obviating any dismantling of any parts for wiring. It is, in effect, a switch box, with brass terminals projecting at the top and plungers at the bottom. The enhanced facility in wiring is obvious, since the only part to be removed is the actual bakelite cap, when wires can be directly connected to terminal heads. The switch itself is of the compression-spring type, with floating rocker arms, self-cleaning contacts and with a quick make-and-break action that cannot be slowed down. The switch mechanism and current-carrying units are not only dustproof and foolproof, but cannot suffer from corrosive effects of atmospheric conditions. Another novel feature is the cord grip; a rubber cone of substantial proportions provides a resilient "bed" for the wires, but also allows for various sizes to be used. The whole design is substantial, and terminals and plungers are of ample current-carrying capacity, while a strong metal bayonet cap is fitted. The holder is highly finished in brown bakelite, and provided with a skirt or shade ring.

An Insulation Stripper.

The Siemens-Schuckert Co., of Berlin, have recently introduced a useful simple hand tool for removing the insulation from all kinds of wires. The insulation stripper consists of a flat piece of steel with the ends bent toward each other and notched. By the use of the tool it is possible to save considerable time in removing the insulation from the ends of wires, this being of special advantage as regards multiple-core cables for communication circuits. A further advantage of the tool is that by its use it is impossible, it is claimed, to damage the copper core of the cable. The stripper is made in two different sizes: size 1 has three notches all of the same size, and is intended for stripping the insulation from Nos. 21 and 23 s.w.g. wires; size 2 has two notches for Nos. 17 and 19 s.w.g. wires.

Speed-Reducing Apparatus.

Mr. C. CAMPART, 32-34, Theobald's Road, W.C.1, has introduced in this country a range of "R.V.R." speed reducers for use with electric motor drives. There are six types of reducers, and they cover the wide range of from 1-8 to 1-2,400. Fig. 4 shows the arrangement of the No. 2, double-reduction reducer. The screws are machine-cut in hard steel, and the cog wheels are of phosphor-bronze with hollow, machine-cut teeth in helical lines. The "Carter" gear case is of aluminium, and, it is claimed, perfectly watertight. The reducer is coupled to the motor through a friction clutch. Claims for the

"R.V.R." reducers are smooth starting; noiseless running; and minimum space.

A New Earthing Device.

A new earthing apparatus which has been introduced by the Paragon Electrical Co., 137, Victoria Street, S.W.1, is the "Paragon" earth bottle, fig. 3, a development of the well-known "Paragon" earth cone. The outfit includes a 20-gauge copper bottle containing charcoal, a heavy copper flexible tube which serves to supply liquid to the bottle and

Fig. 3.—The "Paragon" Earth Bottle.

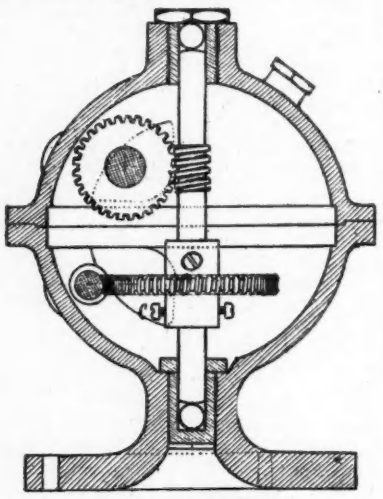


Fig. 4.—"R.V.R." No. 2 Speed Reducer.

acts as a conductor, and a suitable clip for the wire connection. A series of holes are drilled round the bottle, so that it serves to keep the surrounding soil wet. The bottle can be connected to a water supply, or it can be arranged to collect surface water, *via* the tube.

An Electrical Speed Indicator.

The accompanying illustration, fig. 5, shows an electrical speed indicator, a recent production of Messrs. F. A. Wilkinson & Partners, Ltd., Hatfield, Herts. It comprises a small dynamo, which generates a voltage directly proportional to its speed, connected to an indicating instrument by means of a cable. It is claimed that the electric type of speed indicator is more lastingly accurate than mechanical and

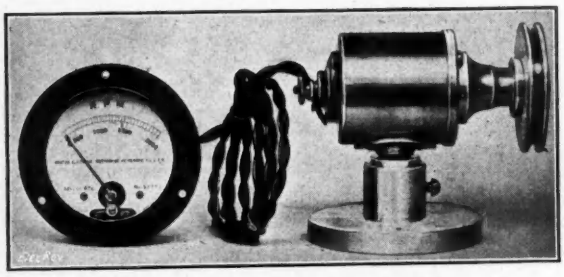


Fig. 5.—"Wilkinson" Speed Indicator.

other types. The indicating instrument is of the dead-beat type made by the Weston Electrical Instrument Co., Ltd., and is calibrated in revolutions per minute, which can be read at any moment without the aid of a stop watch. The generator is driven by means of a round belt or directly connected to the device whose speed is to be measured.

Fixing "Fultograph" Pictures.

For a long time past attempts have been made to render permanent the pictures received by the "Fultograph" on paper treated with starch and potassium iodide. Such pictures may last for several months if the paper is dried quickly as soon as it has been removed from the cylinder and is afterwards not unduly exposed to strong light, but no means could be found of making them as permanent as photographic prints. Credit for the discovery of a method of fixing "Fultograph" prints belongs to an amateur, Dr. Alfred J. H. Iles, of Taunton, who discovered that the key to the problem was common inexpensive alum. After reception, the picture is laid face downwards in a dish containing a solution of alum and ordinary tap water; one teaspoonful of alum to a pint of water is a satisfactory mixture. The picture then becomes as permanent as a photographic plate, or print, after fixing.

Reviews.

Engineering Electricity. By R. G. Hudson, S.B. Second edition. Pp. viii+214; figs. 209. London: Chapman and Hall, Ltd. Price 12s. 6d. net.

This book is of a somewhat unusual type, in that the author has attempted, within the narrow compass of about 140 pages, to give a concise and logical treatment of the elementary theory of what is usually called heavy electrical engineering. The remainder of the book comprises a number of illustrations of electrical machines and appliances, which would seem to increase the size and price of the volume without materially adding to its value, together with a collection of numerical examples for solution, the answers to which are given. In the first part of the book the author has, we consider, been very successful. Although it has not been possible, in the limited space, to give more than a skeleton presentment of electrical engineering theory, this part of the book is quite readable, and it should be even more useful as a work of reference for occasional revision by the ordinary electrical engineer than as a text book for engineering students, whose interest in electrical matters is only secondary. It is for the latter class of readers that the author has written the book, and for this class the condensation may be a disadvantage. The collection of numerical examples is quite good and covers the ground admirably. A fair knowledge of mathematics is assumed, and the elementary calculus is used where it is required for an adequate treatment of the subject. The aim of the author has been to develop the reasoning power of the student who uses his book, rather than to present a number of more or less disconnected facts, and the logical sequence has been well preserved.

After defining the fundamental electrical quantities, the author deals with their relationship in a rather unusual way, Ohm's law not being stated in its usual form. The application of the elementary principles to combinations of resistances and to direct current transmission-line calculations is briefly dealt with. After two chapters devoted to the subject of electromagnetism and electromagnetic induction, the theory of direct current generators and motors is treated very clearly. A short chapter on direct current measurements then follows. In the next chapter, dealing with the basic theory of alternating currents, the mathematics is somewhat cumbersome in parts, and clarity seems to have been sacrificed to formal exactness. In the short chapter on alternating current measurements, the basic principles of a.c. ammeters, voltmeters, wattmeters, and frequency meters are briefly but clearly set out. Dealing with three-phase circuits, we note that the author has included the conventional trigonometrical exercise, showing how to find the power factor of a three-phase circuit from the readings of two wattmeters, without mentioning the important fact that the results obtained from the formula deduced are quite useless unless the circuit is balanced. A short chapter on the calculation of the voltage regulation in short transmission lines then follows. The treatment of the alternating current generator is so brief as to be scanty and unsatisfactory, and, although the manner in which the division of load current and wattless current between two alternators operating in parallel is referred to, this important point is not explained, nor is it illustrated by the usual vector diagrams. There are chapters on the synchronous motor, the rotary convertor, and the mercury-arc rectifier. The treatment of the static transformer is very satisfactory, but the chapter on the induction motor would have been more useful if the theory of the simple circle diagram had been given, and its application to the induction machine explained. The final chapter deals very briefly with the series commutator motor.

Operational Circuit Analysis. By Vannevar Bush. Pp. x+392; figs. 102. London: Chapman & Hall, Ltd. Price 22s. 6d. net.

Such is the power of mathematicians that a mere handful of them can guide and control the activities of a whole regiment of ordinary engineers. Unfortunately the ordinary engineers, of whom the present reviewer is one, do not always appreciate this as much as they should. Only too often the engineer has little knowledge, not only of mathematics itself, but of its potentialities in the hands of experts, and he has, what is worse, no toleration for any subject which is beyond him. The result is that only too often he gets in a mess which he could have avoided if he had invited the co-operation of mathematics; he decides questions by vague intuition which are really matters of hard arithmetic, and decides them wrongly. He then spends a great deal of time, labour, and money on "try this, try that" methods to get out of his difficulties. He calls that being practical.

When Heaviside developed operational analysis for the solution of engineering problems he found little favour with more formal mathematicians for whom his methods were crude. Though serviceable for practical problems, operational analysis was too far from the track of the more abstract mathematics of the day. Yet so great was the gulf between mathematics and engineering that what was altogether too rough and ready for the pure mathematician was still far too unlike the engineers' ideal of "mathematics without tears" to find acceptance. It may be admitted that its author did not present it in a very acceptable form.

There are, however, signs of a change, most pronounced in America. The large firms there have their own research departments, staffed by a handful of highly trained scientists to guide the rest of the regiment of engineers in the firms. At least a few British electrical firms have followed suit, and now we are getting a small crop of books over from America in which Heaviside's operational analysis methods are presented in a form that could perhaps not be yet described as "without tears," but with which a young engineer with a reasonably good mathematical training may hope to master the subject. This certainly appears to apply to the book under review. The advanced student, desirous of acquiring facility in the mathematical handling of circuit problems, should find the study of this book immensely profitable. But to the present reviewer, who is not qualified to discuss the mathematical reasoning in the book, it appears to be something more than the ordinary advanced text-book. It does not only show how to *solve* problems, but also how to *visualise* them. It brings a wider perspective and should therefore provide a useful training in outlook, even to those who do not wish to learn to apply the method of operational analysis.

Not the least valuable educational feature of this book is its insistence on the general applicability of the mathematical method to all analogous engineering problems. The story of the little boy is well known, who had learnt to do his sums in apples but could not do them in oranges. We are all rather like that little boy. If we are electrical engineers we may be able to solve a problem in resistance, self-induction and capacity, but may yet be at a loss when faced with an analogous mechanical or hydraulic problem. In the book under review all engineering problems requiring the same mathematics are dealt with impartially. Any material system to which the formulæ for an electrical circuit apply is a circuit problem, whether the system be one of pipes or pendulums or heat flow. In accordance with this a circuit is given the broadest possible definition as "a physical entity in which varying magnitudes can be sufficiently specified in terms of time and a single dimension."

R. O. KAPP.

Electric Drive Practice. By GORDON FOX. Pp. viii+421; figs. 170. London: McGraw-Hill Publishing Co., Ltd. Price 17s. 6d. net.

The application of the electric motor to the driving of all kinds of machinery, which constitutes so important a factor in the economic development of almost every phase of an industrial life, renders the appearance of a book such as this particularly opportune. Indeed, it is remarkable that such a book has not been written and published before. As the title implies, the book endeavours to investigate the most suitable form of electric motor which should be employed for driving the various forms of machinery used in modern industry, and while it would obviously be impossible within the scope of a single book of reference to cover the whole gamut of commercial machines, it may be admitted that within the limits of his 421 pages the author has surveyed a very wide field. The days are past when it was sufficient to obtain an electric motor of the requisite power and to couple it to the machine through some form of starting regulator. To-day, the choice of electric motors is so wide and the demand for economical operation is so insistent that it is essential for each problem to be investigated separately if the best results are to be obtained, and this is what the book under review sets out to do. Unfortunately, however, the present volume represents only one-half of a complete work. The author postulates that the essential conditions for the successful application of the electric motor to the driving of industrial machinery are: first, familiarity with the various types of motors and their performance characteristics; second, a knowledge of the principles of electric controllers, their function and their adaptation; and, third, information, both general and specific, of the machinery to be driven and consideration of every aspect of its action which affects the drive. The first two of these three essentials he has treated in a companion volume entitled "Principles of Electric Motors and Control," and a knowledge of the contents of this is presupposed in the present volume. Thus, in discussing, for example, the electric drive for mine hoists, the author tells us that "wound-rotor induction motors with secondary resistance control are very widely used, but he does not in the present volume attempt to show why this type of drive is employed or to justify its use. In other words, a good knowledge of the various forms of electric motors and of their control gear is essential to the complete understanding of the contents of this book.

With this limitation kept in mind it may be of interest to give a brief summary of the field surveyed by the author. After an opening chapter on the advantages of the electric motor drive, the factors governing the selection of the motor and its control equipment are discussed, this being followed by two chapters dealing, respectively, with the mechanical features and the electrical features of the installation. In the former the important problem of foundations or supports, flexible drive, &c., are considered, while in the latter the wiring, protection of circuits, mounting of starters, &c., are dealt with. The remaining twelve chapters are devoted to various types of machine, including fans, compressors (both reciprocating and rotary) pumps, cranes, conveyors, hoists, and elevators, a large chapter being reserved for machine tools, while a shorter one discusses the problem of industrial electric traction, that is to say, the short-distance transport of materials and goods from one part of a works to another. Comprehensive as is the list of machines considered, it leaves out many important types, notably, the steel rolling mill on the heavy side and the spinning loom on the light side, just to mention two. There is a growing tendency on the part of designers of all kinds of machinery to consider, not merely the machine itself, but also the way in which it is to be driven, and while, as we have shown, the author has not been able to include many important types, we heartily recommend this book to all those designers of machinery who are desirous of incorporating the electric motor in their designs. To the installation engineer this book can also be recommended with confidence, as the valuable data included within its pages should go a long way towards yielding a solution of the problem of the choice and erection of a suitable motor and its control gear for any particular machine.

Electrical Transmission and Distribution. Edited by R. O. KAPP. Vols. VII and VIII. Pp. viii+viii+1567—1976; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price, Vol. VII, 6s. net, Vol. VIII, 3s. net.

The two concluding volumes of this work are concerned principally with instruments, meters, relays, and auxiliary apparatus, and will appeal more particularly to those engaged in the test departments of electricity supply undertakings. In Vol. VII we have two sections contributed by Mr. H. Cobden Turner dealing, respectively, with indicating instruments and instrument transformers. In the first of these sections the bulk of the limited space available is devoted to a.c. ammeters and voltmeters, and there has, apparently, been no room left for a reference to induction wattmeters or to power factor meters. The references to the potentiometer and to magnetic testing are too brief to be of much use and are perhaps somewhat out of place in a work of this character. The section dealing with instrument transformers is mainly descriptive in character, but the author is not very happy in his treatment of the theory of these transformers. Mr. H. Hugh Jaques has had a difficult task in dealing with the wide subject of electricity meters in the very restricted space allotted to him. Here again the matter is generally descriptive in character, but a fair amount of space has been allocated to the subject of three-phase metering. It is somewhat surprising that we here have perpetuated the fallacy that the impedances of the three voltage coils of the instruments must be equal when the three wattmeter method of power measurement is employed. This condition must be satisfied if each of the wattmeters is to give the power in the phase with which it is associated, but the sum of the wattmeter indications gives the total power irrespective of the equality of the voltage circuit impedances. In fact, the two-wattmeter method may be conceded as a limiting case of the three-wattmeter scheme, in which the impedance of the voltage coil of one of the wattmeters becomes negligible. The treatment of the problem of metering three-phase four-wire supplies is very clear and quite accurate. It is a pity that sufficient space has not been provided in this section for a reference to such special instruments as reactive and kVA meters.

The section dealing with Meter Department Operating Routine has been very well written by Mr. Oliver Howarth. This section comprises much good and useful matter relating to the work of the meter department of a supply undertaking, and to the testing of consumers' meters. We find here some interesting notes on the subject of obtaining artificial power factors from a three-phase circuit. The reference to the testing of instrument transformers is too brief to be of much use to those unaccustomed to this work.

Dr. C. C. Garrard contributes an interesting section dealing with the details of the construction of relays and apparatus used in connection with automatic and remote control gear. This will be found a useful sequel to a previous section on automatic protective gear. Dr. Gerrard is a very clear writer, and his lucid descriptions of modern systems of protection and of supervisory remote control gear will be found most useful and informative by sub-station engineers.

The concluding volume of this work, opening with a section by Messrs. W. A. Benger and R. E. Hopkins, entitled Electric Boosting Devices, deals with a.c. boosters and automatic voltage regulators. The same authors contribute a brief section dealing with Power Factor Correction. Appendix I is a Short Summary of the Law of Electricity Supply, written by Mr. W. Eric Jackson. This is an admirable and useful contribution, which should be studied by all electricity supply engineers. The second Appendix, contributed by Capt. R. Stillingfleet, deals with the development of the h.p. circuit breaker and gives an account of recent research work in this field.

The work badly needs a comprehensive complete index to make it thoroughly useful as a reference book on distribution work. The indexes to the several volumes are much too short to be of any great service in this connection.

Ultra-Violet Radiation and Actinotherapy. By ELEANOR H. RUSSELL and W. KERR RUSSELL. Third edition. Pp. 648; figs. 259. Edinburgh: E. & S. Livingstone. Price 21s. net.

The subject of this volume is one which is growing with astonishing rapidity, due no doubt, to some extent, to the combined advertising efforts of makers of equipment and proprietors of artificial sunlight "cure-all" establishments, as

well as to the influence of the technical and lay Press in general, an influence which has perhaps been more far-reaching than was expected or desired.

Some of this growth may prove ephemeral, but in its proper sphere and in competent hands the curative and stimulative effects of ultra-violet radiation are now firmly established.

The volume under review is a new edition of a work which first appeared in 1925 with 262 pages and 77 illustrations. In the present (third) edition of 1928 there are 648 pages and 259 illustrations. These facts speak for themselves, but a brief outline of the various chapters will be informative as to the scope of the book.

The introduction is of great general interest to any class of reader and deals with the origin and purpose of actinotherapy, the place it now holds, and that which it is likely to occupy in future as one of the curative agents at the disposal of the medical profession.

The dangers attending the unqualified use of all types of radiation are stressed, as may be illustrated by the following quotation (page 35):—

"It cannot be denied that at present we are experiencing a boom in ultra-violet treatment in the lay Press, and it is certainly deplorable that, in this country, persons without any qualification whatsoever, are allowed blatantly to advertise the administration of ultra-violet treatment."

The importance of natural sunlight is prominently and properly emphasised, and the highly detrimental influence of the smoky atmospheres, which still continue to be tolerated in populous areas, are dealt with and illustrated by means of appropriate photographs.

The first chapter is historical, and ranges from the dawn of history, with its cult of Sun Worship, to the pioneer work of the founder of modern actinotherapy—Professor Niels Finsen.

The second chapter deals with radiant energy, which also forms the theme of the foreword to the book from the pen of Sir Oliver Lodge. Thereafter follow descriptions of all important types of equipment for the production of ultra-violet rays, including details of the methods of employing direct or alternating-current supplies according to circumstances. The chemical, physical, and biological effects of the rays are discussed in chapters seven, eight, and nine, and the two following chapters treat of pathology and technique.

The remainder of the book is devoted to specific applications to the human subject, including dental, ear, nose, throat, and eye technique, and a few pages treat of the employment of ultra-violet radiation in veterinary work.

A bibliography of six pages and an index of sixteen pages complete a work which can be recommended to any reader interested in the progress and development of a wonderful agent, the study of which may be said to be as yet in its infancy. To the medical man, whether engaged in actinotherapeutic practice or merely contemplating its employment for the first time, the book provides most, if not all, of the general information likely to be required, and anything not found among its pages will probably best be learned through practical experience in the applications of the treatment in the course of the everyday work of the practitioner.

The last few lines of Sir Oliver Lodge's foreword may fittingly be quoted in conclusion:—

"Naturally, I express no opinion on purely medical matters; but a book dealing with this comparatively new and highly promising subject, by people with medical training, physical knowledge, and extensive and rapidly-growing experience, should be welcome. I judge that this is such a book, and commend it accordingly."

C. N. K.
J. L. T.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Standardising Wayleaves for Rural Electric Lines.

A year has elapsed since the Overhead Lines Association issued its proposed Standard Form of Agreement for Wayleaves. It was sent generally to the Press (and to the public at cost). It is believed that the time is opportune to summarise the comments that have been received and that have appeared in the Press dealing therewith.

No one has adversely criticised it. A few have regretted that the annual payments detailed in it are high.

In at least two articles specific mention has been made of the wayleave agreement (blank) forms issued by the Incorporated Municipal Engineers' Association covering ten sheets. In each case appreciation of the work was generous, but their cumbersome size and complete absence of any standard conditions were commented on. They provide blanks for each farmer to fill in in a different way.

No one has expressed appreciation of such unnecessary variations in conditions that can be easily standardised.

One who is neither a municipal nor a company engineer sees no reason for differentiating between their points of view, and bears no *animus* in either direction. The I.M.E.A. wayleave forms are taken as typical of what need improvement, simplification, and, above all, true standardisation of conditions. Unless this is accomplished rural distribution will not progress as it should.

Every municipal engineer has his corporation's solicitor handling the legal part of the work, and does not bother about the cost. There is no reason why separate solicitors' fees should be incurred for every separate owner, and it is generally agreed that the necessity to pay one's own costs for solicitors and arbitrators definitely tends to prevent unnecessary reference to them.

This is an essential economy, tends to result in a lower selling price, and is embodied in the proposed O.L.A. wayleave form. No one doubts that a solicitor engaged to oppose a case can find fault with a simple agreement which leaves unsaid all the possible alternatives and complications, but no one has criticised the absence of complications from the O.L.A. proposed wayleave form.

No one questions the difficulty which public officials meet if they appear so to simplify matters that the solicitor is not called in; but the writer submits that in spending a few shillings, or a few pounds, on every-day occurrences we manage to do so quite simply, using the plain language of the man in the street; and we get along quite satisfactorily with a minimum of legal terminology and have always found that the solicitor is equally willing that we should conduct such matters independently.

Cumbersome agreements (such as I.M.E.A.'s) call for as much arbitration and litigation as simpler ones. Requiring six months' notice to alter the position of a line when a farmer decides to build where the line interferes is quite unreasonable, and no municipal engineer would accept such delay if the farmer were to specify it as a condition precedent to getting on with electrical work. So why should the I.M.E.A. impose it on the farmer?

Bearing in mind that out of the considerable number of landowners who have appealed to the Ministry of Transport against their lands being traversed by electric distribution lines, only about three or four (and those for very especial and peculiar reasons) have been successful in preventing the installation, the writer submits that in a large majority of cases landowners and tenant-farmers are not unwilling to facilitate the supply of electricity on their own land and to their neighbours beyond, without the intervention of solicitors, and with the economy thereby entailed in time and in money.

An agreement form which leaves every condition to be varied loses all the object of its existence. The O.L.A. proposed form definitely fixes every condition it mentions, brings all agreements to one basis, economises in every way, and gives to the landowner all the legal protection he needs.

The O.L.A. form reads as follows:—

"The owner (or occupier) of land across which conductors supported on poles will be necessary to supply electricity thereon and to others beyond *will give*

(1) reasonable access,
(2) reasonable notice if building work necessitates alteration of route; *will provide*
(3) near-by alternative position for supports; *will retain*
(4) this agreement as applying to such altered positions, *will permit*
(5) necessary lopping or felling; *will indemnify* against
(6) tenants' claims;
(7) each party will pay his own expenses in connection with signing this form.

"The authorised supplier of electricity *will pay to the owner*—

(a) *For distribution lines* from quarter day next after commencing erection at the following rates per complete support, including stays:

(8) One shilling per annum in mowing grass or pasture.
(9) Eighteenpence per annum in corn or ploughed land.
(10) Two shillings and sixpence per annum on demand when steam ploughed with rope tackle.

(b) *For Main Lines* (*i.e.*, over 25,000 volts):

(11) Five shillings per annum in mowing grass or pasture.
(12) Ten shillings per annum in corn or ploughed land.
(13) No rent will be charged for supports in uncultivated land or hedge; and *will pay to the occupier*—
(14) One half the above rates in addition.

"A plan showing positions proposed for supports accompanies the agreement; the erecting will be proceeded with promptly; the work will be done to the reasonable satisfaction of the Electricity Commissioners; if damage is done it will be made good; if injury is caused it will be indemnified; statutory notice of new works will be posted.

"If considered necessary to terminate this agreement, reasonable notice will be given, subject to statutory appeal to the Minister of Transport.

"Any claim not amenable to mutual concessions shall be written by the aggrieved party to the other party, together with the names of at least two alternative proposed *local* or other independent arbitrators. The second party shall without delay send his reply in writing and the acceptable arbitrator's name. Each shall be responsible for delivering his own 'case' to the mutually acceptable arbitrator, whose decision shall be final and binding on both.

"If the selection of an acceptable arbitrator is not promptly

practicable, the second party shall be responsible for a request to the Minister of Transport to appoint an arbitrator, who shall give a binding final decision.

"Each party shall pay his own costs, also one half of the arbitrator's fee on demand."

Theodore Stevens.

London, *August 10th*, 1929.

S.O.S.—Save Our Strawberries!

An interesting inquiry has been made on the subject of protecting strawberries from frost.

The inquiry relates to a five-acre field, and the problem is to raise the temperature of the air within a few inches of the ground during frost periods in early spring and onwards. The capital cost, interest, maintenance, and running costs, spread over a period of four years only, are not to exceed £1,200, with electricity at 2d. per kWh.

Will any of your readers be good enough to come to the assistance of one who knows more about the turkey-capacity of cookers than the mysteries of electro-farming?

Sales Engineer.

August 6th, 1929.

Legal.

Workmen's Compensation.

THE *Manchester Guardian* reports that the Distillers, Ltd., Salt End, Hull, were fined £25 by the magistrates at Hedon on August 8th for not adequately protecting a live overhead electric wire. Workmen, acting contrary to orders, were working on pipes when Alfred Lound slipped and clutched hold of a wire to save himself, receiving a fatal shock. The prosecution maintained that employers must adopt precautions against inadvertence and disobedience. The defendants contended that the height of the overhead wire was a precaution against danger and the workmen themselves were solely responsible for the fatality.

Failure to Earth Efficiently.

AT Church Police Court, on August 8th, Messrs. C. & W. Walmsley, of Three Brooks Mill, Oswaldtwistle, cotton manufacturers, were ordered to pay the costs for failing to earth efficiently electrical apparatus where a person was liable to get a shock. Inspector Jones said the regulation was for the protection of persons ignorant or unskilled in electrical matters. Two portable lamps were used inside a large boiler. One had an ordinary brass holder which was not earthed, and was consequently highly dangerous. The Home Office desired to emphasise the dangers which arose from such holders being used, particularly in the case of alternating current. Mr. W. Brown, electrical inspector of factories, said the use of such lamps had been a prolific cause of accidents.

For the defence it was stated that employers were not aware an ordinary lamp was being used.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

1,959. "Electric circuits for central telephone offices." Ericsson-Fatme and A. Rosa. January 20th, 1928. (Convention date not granted.) (283,971.)

4,887. "Registering and/or recording devices for electromotors." J. Fides. February 16th, 1928. (315,674.)

5,342. "Transformer cores and the methods of assembling such cores." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). February 20th, 1928. (315,893.)

8,104. "Circuit arrangement for telephone installations with semi-automatic working." Siemens & Halske Akt. Ges. December 10th, 1927. (302,140.)

8,498. "Electroplating." J. Q. Macdonald and W. M. Scott. October 22nd, 1927. (299,298.)

10,521. "Electric light and like switches." R. Mawby and A. C. Holt (trading as Homa Engineering Co.). April 10th, 1928. (315,775.)

10,854. "Electric relay devices." G. L. Porter and Ferranti, Ltd. April 12th, 1928. (315,679.)

11,217. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. O. Passmore, and R. Taylor. April 16th, 1928. (315,735.)

11,226. "Electric igniters for cigarettes and the like." N. C. F. Jensen. April 16th, 1928. (315,685.)

11,233. "Regulators for controlling the speed of electric motors." Electrical Research Products, Inc. June 21st, 1927. (292,530.)

11,281. "Contacts for electric fuses, switches, and the like." V. Hope. April 17th, 1928. (Cognate application 5,187/29.) (315,739.)

11,323. "Apparatus for energising potential circuits in accordance with the voltage on the high-tension side of a power transformer." A. Reyrolle and Co., Ltd., and J. A. Harle. April 17th, 1928. (315,744.)

11,362. "Vehicle headlights." A. H. Midgley. April 17th, 1928. (Cognate application 16,306/28.) (315,749.)

11,379. "Junction and fuse boxes for multi-core cables." Siemens-Schuckertwerke Akt. Ges. May 28th, 1927. (291,084.)

11,594. "Motor-vehicle electric headlights." J. Lucas and O. Lucas. April 19th, 1928. (315,817.)

11,695. "Brush-gear for dynamo-electric machines." Sir C. A. Parsons and J. Rosen. April 20th, 1928. (315,908.)

11,706. "Gasfilled discharge vessels, more particularly for use as rectifiers." Siemens & Halske Akt. Ges. April 25th, 1927. (280,361.)

11,730. "Telephone systems." Associated Telephone and Telegraph Co. April 22nd, 1927. (289,065.)

11,731. "Switches for use in telephone or like systems." Associated Telephone and Telegraph Co. April 30th, 1927. (289,773.)

11,780. "Coin-freed telephone apparatus." C. A. Cambay. October 6th, 1927. (Patent of addition not granted.) (298,216.)

12,146. "Means for transmitting mechanical movements to the interior of vacuum vessels." Siemens-Schuckertwerke Akt. Ges. June 8th, 1927. (291,758.)

12,589. "Electric relays." Park Royal Engineering Co., Ltd., and J. E. D. Holder. April 30th, 1928. (315,926.)

12,796. "Electron discharge devices." British Thomson-Houston Co., Ltd. August 19th, 1927. (295,702.)

13,593. "Watertight electrical switch and fuse cases." J. P. Annacker. May 9th, 1928. (315,937.)

13,642. "Adjusting device for the driving systems of induction measuring instruments." Landis & Gyr Soc. Anon. September 24th, 1927. (297,670.)

13,686. "Electric lighting systems." A. H. Mackay and L. W. Slade. May 9th, 1928. (315,938.)

13,742. "Commutation of electric currents." J. F. Gill, J. N. Chaviara, and F. J. Teago. May 10th, 1928. (315,940.)

14,025. "Electric couplings." H. Baron (Compagnie Lorraine de Charbons pour l'Electricité). May 12th, 1928. (315,942.)

14,247. "Transformers for supplying electric current to discharge tubes." Dr. Dietz and Ritter Ges. May 18th, 1927. (290,633.)

16,558. "Watertight motor with short-circuit rotor." M. Surjaninoff. March 20th, 1928. (308,244.)

16,862. "Process of rapid electric-stunning of cattle and pigs for slaughter." A. Weinberger. June 11th, 1928. (315,962.)

17,043. "High-tension transformers." Akt. Ges. Brown, Boveri et Cie. June 13th, 1927. (297,107.)

17,274. "Frame or loop aerials for radio sets." E. J. Lever (Trix), Ltd., and D. A. Lyons. June 14th, 1928. (315,964.)

18,390. "Distance relays for the protection of electric circuits." Siemens Schuckertwerke Akt. Ges. June 25th, 1927. (292,930.)

18,992. "High-speed circuit breakers." B. Thomas and E. Thomas. June 30th, 1928. (315,983.)

19,785. "Radio direction finders." Radio Communication Co., Ltd., and F. P. Best. July 7th, 1928. (315,990.)

20,524. "Vehicle electric lamps." Butlers, Ltd., and A. Reeves. July 14th, 1928. (315,994.)

20,569. "Remote electric metering systems." Associated Electrical Industries, Ltd. July 15th, 1927. (294,115.)

21,100. "Cathode-ray oscillographs for taking photographs of non-repeating phenomena." Dr. W. Rogowski and Dr. E. Fleger. August 1st, 1927. (294,934).

21,271. "Apparatus for reproducing and transmitting sound." British Thomson-Houston Co., Ltd., L. B. Ault, A. P. Young, and J. H. Butcher. July 23rd, 1928. (316,005.)

21,363. "Sound-reproducing devices such as loud-speakers." A. P. Welch. July 23rd, 1928. (316,007.)

21,896. "Manufacture of oxidecoated cathodes for use in vacuum electric devices." Octron, Ltd., W. Holt, and G. H. Stedman. July 28th, 1928. (316,015.)

23,081. "Incandescent-filament lamp fittings." Aktieselskabet Kjobenhavns Lampe-Og. Lyskronefabrik. August 12th, 1927. (295,394.)

23,547. "Combined dry surface-contact rectifier and small output transformer." Siemens-Schuckertwerke Akt. Ges. July 12th, 1928. (315,342.)

24,543. "Telephone number indicator." J. Gaunt and L. E. Gaunt. August 27th, 1928. (316,038.)

24,768. "Transformers." Akt. Ges. Brown, Boveri et Cie. September 12th, 1927. (297,030.)

25,399. "Electric low-tension or incandescent igniters for blasting fuses." K. Schaffer-Glossl. September 4th, 1928. (316,042.)

25,417. "Switch with compressed-air arc extinction." Siemens-Schuckertwerke Akt. Ges. October 22nd, 1927. (299,301.)

25,474. "Electric contact fingers." British Thomson-Houston Co., Ltd. September 7th, 1927. (296,760.)

26,001. "Process of manufacturing closing wedges for the grooves of dynamo-electric machines." Limited Company, formerly the Skoda Works, Pizen. September 14th, 1927. (297,084.)

26,415. "Magneto or dynamo-electric machines." M-L Magneto Syndicate, Ltd., and E. A. Watson. September 14th, 1928. (316,046.)

31,845. "Vacuum electric tube devices." Westinghouse Electric and Manufacturing Co. November 2nd, 1927. (299,853.)

33,894. "Apparatus for cleaning the electrodes in electrical gas-purifying plants." H. Zschocke. November 19th, 1928. (316,071.)

37,248. "Alternating-current commutator motors." British Thomson-Houston Co., Ltd. December 22nd, 1927. (302,909.)

1929.

17,465. "Control of the air supply for electric motors and generators." J. E. Allan. March 15th, 1928. (Divided application on 7,911/28.) (Cognate application 17,466/29.) (315,687.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from August 7th:—

Protofix. Nos. 498,383, 498,384, 498,385 and 498,386. All goods in Classes 6, 8, 9 and 10.—Siemens & Halske Gesellschaft, 101-110, Nonnendamm Allè, Siemenstadt, Berlin, Germany. (British representatives: Haseltine, Lake and Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Vertex. No. 501,387. Class 6. Electrically-driven pumps.—A. G. Mumford, Ltd., Culver Street, Colchester.

Olgatone (lettering and design). No. 503,315. Class 8. Wireless telephonic instruments and apparatus and parts thereof.—Jules Hiller, 52, Whitechapel Road, E.1.

Broadwall. No. 503,773. Class 18. Electric lighting and pumping plants.—Broadwall Engineering Co., Ltd., 53, Victoria Street, Westminster, S.W.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABINGDON.—Factory, for the M.G. Car Co., Oxford.

ACCRINGTON.—Police and fire stations; borough engineer.

ALDERSHOT.—Housing scheme (30 to 40), for the T.C.; borough surveyor.

ASFORDBY (Melton Mowbray).—Houses (50), for the Stanton Ironworks Co., Ltd.

BEDWELLTY.—Additional 54 houses, Blackwood, for the U.D.C.; Dan Price, surveyor.

BEXLEY.—Houses (62), Westwood Lane, Welling, for T. H. Jones.

BISHOP STORTFORD.—Warehouse, workshops, &c., Bastow Lane, for G. E. Sworder & Sons.

BLACKBURN.—Housing scheme (200), Whitebirk and Hollin Bridge Street areas; borough engineer. Additions to works, Chapel Street, for H. J. Lonsdale. Warehouse, Cicely Bridge Mill, for J. Baynes, Ltd.

BLACKPOOL.—Amusement hall, office, shops, &c., on site of big wheel (£20,000); T. Blackburn & Sons, engineers, Preston.

BOLTON.—58 houses, Cameron Street; Middleton & Co. (Blackpool), Ltd. Elementary school (750 places), Whitecroft Road; Education Committee.

BOSTON.—Housing scheme (53), for the R.D.C.; surveyor.

BUCKINGHAM.—School, for Bucks. E.C.; director of education, Aylesbury.

CAISTOR.—Grammar school extensions (£7,794), for Lindsey E.C.; Moore Bros., builders.

CAMBRIDGE.—County hall (£57,405), for Cambs. E.C.; county architect.

CHARTHAM.—Extensions, sanatorium (£17,000); Kent C.C.

CHESTER.—Extensions, county offices; Cheshire county architect.

CROOK.—School (800 places), for Durham County E.C.

DARLINGTON.—Extensions, War Memorial Hospital (£36,000); Gustavus Bailey, Ltd., builders, Newcastle.

DEAL.—Police station, &c., for Kent C.C.; county architect, 86, Week Street, Maidstone (returnable deposit of £2).

DERBY.—Extensions, isolation hospital, with central heating and lighting (£50,000), for the T.C.; borough engineer.

DIDSBURY.—Cinema and shops, Parrs Wood Road and School Lane, for Regal Cinema Co., 27, King's Street West, Manchester (£30,000); P. Cummings, 51, King Street, Manchester.

EDINBURGH.—Mill at Colinton, for A. & R. Scott, West Mills, Colinton; the manager. Reconstruction of clearing house and exchange; manager, Bank of Scotland.

EVESHAM.—Housing scheme (32), for the T.C.; J. Abbott, borough surveyor (returnable deposit of £1 1s.).

GLASGOW.—500 houses, Burnside; Glasgow Estates Development Co., Ltd. 120 houses, Janefield Street and 18 Altyre Street; housing director. Extensions, cinema, Wellshot Street; George Green, Ltd.

GREENOCK.—Extensions to spinning mill, for A. Touch and Son; the manager.

HALIFAX.—Operating theatre, St. Luke's Hospital (£12,000), for the Board of Guardians; clerk.

HARROW.—Enlargement of Lower School, for the Harrow School Governors.

HASTINGS.—Workshops, for Coombs Motors, Ltd., East Street; P. H. Oxley, architect.

HOUNSLOW.—220 houses fronting Staines Road; P. Chase Gardener & Co., High Street, architects.

IRISH FREE STATE (Edenderry, King's Co.).—Convent national school; Ashlin & Coleman, architects, 7, Dawson Street, Dublin.

(Callan and Thomastown, Co. Kilkenny).—Lighting and heating by electricity of the courthouses: R. F. Bowen, county surveyor, Courthouse, Kilkenny (returnable deposit of £1).

IRLAM.—Central school, Flixton (800 places), and infants' school, Higher Irlam, for Lancs. E.C.; Mr. Meadon, director of education, Preston.

KINGSBRIDGE.—Grammar school (£12,476), for Devon E.C.; education architect, Exeter.

LANARKSHIRE.—Conversion of church into woollen factory at Leadhills; Rev. R. C. Hunter, minister of the parish.

LEIGHTON BUZZARD.—Wiring installation, Cedars School, for Bedfordshire E.C. (£170).

LONDON (Barking, E.).—School, Becontree housing estate, for the E.C.; C. J. Dawson, architect, Clock House Chambers (returnable deposit of £3 3s.).

(Lambeth, S.E.).—Housing schemes, four sites (£71,000); borough engineer.

(New Cross, S.E.).—Rebuilding Kender Street school (£14,383); W. H. Gaze & Son, Ltd., builders, Kingston-on-Thames.

(Woolwich, S.E.).—Extensions, public hall, and new municipal offices, for the T.C.; borough surveyor.

LYMM (Cheshire).—Installation of electric lighting and motor for organ in Parish Church; rector, Rev. J. Allan Davies.

MANCHESTER. — Housing scheme, Newton Heath (£243,600); city architect. Aerodrome hangars; city engineer and trade contractors.

NEWARK-ON-TRENT.—Additional 64 houses, for the T.C.; borough surveyor.

NEWNHAM (Glos.).—Electric lighting installation, Parish Church; Rev. J. Clayton, vicar.

OLDHAM.—Alterations, Grosvenor Cinema, Union Street; Picture House (Oldham), Ltd. Out-patients' department, Royal Infirmary; governors.

OXFORD.—Rebuilding business premises, 10, St. Ebbe's Street, for E. S. Alden.

PLYMOUTH.—Extensions and alterations, various hospitals (£71,885); borough architect. Aerodrome, Roborough; borough engineer.

RADLETT (Herts.).—Re-erection of "Starve Acres," Watford Road (mansion), for A. F. Part, 9, Ashbourne Place, London, S.W. (£9,000).

RENFREW.—Refuse destructor (£2,000), for Town Council clerk.

ROMFORD.—Rebuilding station (£250,000), for the London and North-Eastern Railway Co.

ST. ALBANS.—Business stores, for the Co-operative Society; secretary, 24, Victoria Street.

SELBY.—Factory, Barlow, for Breda Visada, Ltd., Littleborough, near Manchester.

SHEFFIELD.—Houses, Wisewood estate; S. Higton & Sons (57), M. J. Geeson, Ltd. (47), and C. W. Alflat (40).

SHOTTON.—School for 450; Durham County E.C.

SLEAFORD.—Estate development, off London Road; Marquis of Bristol. Dance hall and seven shops, Market Place; R. Garratt.

SOUTH SHIELDS.—Elementary school (800 places), Cleadon Park; Education Committee.

SPENNYMOOR.—Cinema (£10,000); Tivoli (Spennymoor), Ltd.; A. Vasey, managing director.

STAFFORD.—Extensions, girls' high school (£13,345), for Staffs. E.C.; education architect, Stafford.

STOKE-ON-TRENT.—Extensions, Hartshill Orthopædic Hospital (£17,000); secretary.

STOURBRIDGE.—Senior school, Pedmore Road; Worcestershire E.C.

SURREY.—Extensions, Netherne Mental Hospital (£300,000), with electric lighting and heating work, telephones, &c., for the C.C.; clerk, Kingston-on-Thames.

SWINDON.—Extensions, North Wilts. Victoria Hospital, with heating and lighting work; R. J. Beswick & Son, architects; R. J. Leighfield & Sons, builders.

TUNBRIDGE WELLS.—Waterworks pumping station and plant, Fordcombe (£36,550), for the T.C.; waterworks engineer.

WARRINGTON.—Central area development; Professor Abercrombie and S. A. Kelly. Alterations, central station; Cheshire Lines Committee. Memorial homes (£10,000); Haig Memorial trustees. Premises, Louther Street; Dussek Bitumen Co., Ltd. Machine room, Vernon Street; Castle Rubber Co., Ltd. Additions, Erwood Street, for Warrington Co-operative Society, Ltd.

WARWICK.—Further additions, County offices (£8,750); electric lighting installation, education stores, Northgate Street, and at police headquarters; Warwick county architect.

WILMINGTON (Kent).—Re-erection of "Broomfields" (mansion), electrically equipped, for Captain B. E. Waterman.

WORKINGTON.—Central school, E.C.; director of education.